ELECTRICAL REVIEW

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VIEWS, NEWS AND INTERVIEWS.

A telegraphic cable has just been laid from English Bay, west of Vancouver, to Departure Bay, near Nanaimo, Vancouver Island, a distance of 32 miles. This cable, says the United States consul at Vancouver, replaces an old and imperfect one, which heretofore connected the mainland with Victoria and other points on Vancouver Island. A telegraph line will be connected with the cable at Departure Bay, and will follow the line of the railway from Nanaimo to Victoria; the line formerly in use passed through the forests and was very difficult to keep in repair. It is now expected that there will be uninterrupted communication between the mainland and Vancouver Island.

The Right Hon. Lord Rayleigh was recently re-elected professor of natural philosophy in the Royal Institution.

At a recent meeting of the British Institute of Naval Architects a speaker narrated an incident which, says an exchange, should be remembered by those who press melted lead: "Some years ago, in a factory where lead pipe was 'squirted' by hydraulic pressure, a small hair-like leak occurred. The pressure was 1,500 pounds to the inch. A man going for a spanner crossed the stream, which, acting precisely like a knife, cut open the inside of his thigh and severed the femoral artery. The man was dead in a couple of minutes."

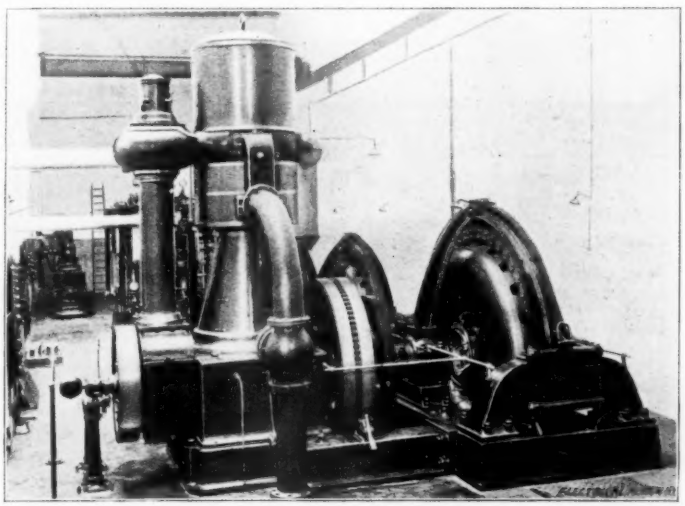
The arrangements for laying the cable from Iceland by way of the Faröe Islands have been completed, and the cable will be laid during the Summer.

The new army hospital ship, known as the "John Englis," of the Maine Steamship Line, has been renamed the "Relief." Through Major George H. Torrey, surgeon, U. S. A., under whose direction the vessel will be refitted, the General Electric Company last week offered to the government a complete X-ray outfit, to be installed on the ship at the company's expense. The offer was promptly accepted. The plant will cost about $400. Besides this, the Women's National War Relief Association offered to equip the wards of the ship with 24 electric fans. This offer has also been accepted.

Oscar M. Stone, a "bucket shop" grain broker, was sentenced last week to six months' imprisonment in the county jail by Judge Grosscup, of the United States Circuit Court, at Chicago, for wire tapping. The offense was committed near Grant Station, Ind.

Inventor S. B. Nickum, of Logansport, Ind., announces that his light globes will be placed on the market this month. They will be sold, according to candle-power, from $1 to $5. Nickum guarantees the globes for five years and says: "In the new light, instead of increasing force upon a given force of matter, I decrease the matter which is surrounded by a constant force of vibration, thereby producing light without heat, which is perpetual." Nickum gets more letters than any man or business firm in town. His callers are numbered by the hundreds, and he is solicited from all over the country to let exclusive territory for the sale of the light. No callers get any further than the door of the laboratory, through a hole in which Nickum asks them their business. Hail to Nickum, the newest genius!

A press dispatch from Albany, N. Y., says that the street surface railroad companies of Manhattan Island contemplate changes of motive power on their lines which will cost more than $30,000,000. These changes will be made as soon as the consent of the State Railroad Commission is obtained, and will cover about 150 miles of street surface roads. Applications for permission to make a change of motive power have been filed with the commission by the Metropolitan Street Railway Company and the Third Avenue Railroad Company for the various lines operated by them, and if they are granted nearly all the roads can be equipped within a year, and surely before the end of the second year after the commission's assent is given. A hearing on the applications will be given by the commission in New York city at the Fifth Avenue Hotel on June 2, at 2 P. M. If the applications are approved by the commission, not only horses as a means of motive power on street surface railroads on Manhattan Island, but cable power as well, will be among the things of the past.



INTERIOR VIEW OF THE ELECTRIC LIGHT STATION AT MALTA. (See page 350.)

THE ELECTRIC LIGHT CONVENTION.

EVERYTHING IN READINESS FOR THE TWENTY-FIRST MEETING OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION AT CHICAGO—THE RAILROAD ARRANGEMENTS—THE PROGRAMME OF THE LOCAL COMMITTEE—OTHER DETAILS OF INTEREST TO DELEGATES.

Under the skilful guidance of experienced officers, the arrangements for the twenty-first convention of the National Electric Light Association are rapidly assuming final form. The convention will be held at the Auditorium Hotel, Chicago, on Tuesday, Wednesday and Thursday, June 7, 8 and 9. The local reception committee has adopted the following programme for the entertainment of delegates and their friends:

On Monday evening there will be a reception at the Auditorium Hotel. On Tuesday evening an excursion to Lake Michigan is the feature. On Wednesday evening Mr. Joseph Wetzler will deliver his lecture on "Electricity Direct from Coal." During the business sessions of the convention on Tuesday and Wednesday, the ladies will be entertained by coaching parties through the city parks and boulevard system, with luncheons in the suburbs.

The Chicago Edison Company has invited the visiting delegates and their friends to inspect its station during the convention. The association badge will entitle the visitor to examine the company's plants at any hour and to obtain any information desired regarding their operation.

The following letter explains itself:

TO THE EDITOR OF ELECTRICAL REVIEW:

As already announced, the various passenger associations have granted a rate of a fare and one-third, on the certificate plan, for delegates and their friends attending the Chicago convention, to be held June 7, 8, 9. Arrangements have been made to have the New York delegation leave Grand Central Station, Sunday, June 5, via New York Central & Hudson River and Michigan Central railroads, on

New York, Boston and Chicago special train, leaving at 1 P. M.; Poughkeepsie, 2.43; Albany, 4.20; Schenectady, 5.05; Utica, 7.03; Syracuse, 8.35; Rochester, 10.47; Buffalo, 11.50 P.M., Central time; Detroit, 8.00 A. M., arriving in Chicago at 3 P. M., Monday. The train leaving Boston at 10.30 A. M., Sunday, June 5, will connect with this train at Albany. This being a limited train, an excess fare of $1 is charged; therefore the railroad fare is $21 and the berth rate $5, making a total of $26. In purchasing tickets, delegates should be particular to obtain a certificate from the agent from whom the purchase is made, as in the absence of this certificate no rebate can be allowed on the return passage. In case the number of delegates attending should warrant, a special train will be run as a second section to the train named. Tickets can be procured at any ticket office of the New York Central Railroad, and space reserved by applying to either the undersigned or M. C. Roach, general eastern passenger agent New York Central & Hudson River Railroad, 413 Broadway, New York.

Yours very truly,
C. O. BAKER, JR.,
Master of Transportation.

New York, May 28.

The complete programme for the twenty-first convention, a part of which has already appeared in the ELECTRICAL REVIEW, is as follows:

TUESDAY, JUNE 7, 1898.

Meeting of the executive committee at 9 A. M., secretary's office, Auditorium Hotel.

Morning session, 10.30 o'clock, Convention Hall, Auditorium Hotel.

Address, President Insull.

Paper, Calvin W. Rice, Brooklyn, N. Y., "Cost of the Generation and Distribution of a Unit of Electricity."

Topic, "Prices and Discounts for Electric Current and Methods of Billing Current to Customers."

Afternoon session, 2 o'clock.

Paper, Alex. Dow, Detroit, Mich., "Public Lighting with Relation to Public Ownership or Control."

Topic, "Legislative Policy as to Public Service Corporations."

WEDNESDAY, JUNE 8, 1898.

Morning session, 10 o'clock.

Paper, Herbert A. Wagner, St. Louis, Mo., "General Distribution from Central Stations by Alternating Currents."

Paper, Louis A. Ferguson, Chicago, Ill., "General Distribution from Central Stations by Direct Currents."

Topic, "Standardizing Apparatus for Central Station Use."

Afternoon session, 2 30 o'clock.

Paper, W. McLea Walbank, Montreal, Canada, "Cost of Producing Electric Power by Water Power from Lachine Rapids, Canada."

Report, Committee on Standard Candle-Power of Incandescent Lamps, Dr. Louis Bell, chairman.

Questions and answers. What is it you wish to know?

Executive session.

Evening session, eight o'clock, Auditorium Hotel.

Lecture, Joseph Wetzler, New York, "Electricity Direct from Coal" (illustrated with stereopticon).

THURSDAY, JUNE 9, 1898.

Morning session, 10 o'clock.

Paper, Prof. Winder Elwell Goldsborough, Purdue University, Lafayette, Ind., "Transformer Economy."

Report, Committee on Amendments to Freight Classification, Jas. I. Ayer, chairman.

Report, Committee on Legislation Concerning Theft of Current, James I. Ayer, chairman.

Afternoon session, 2.30 o'clock.

Topic, "Freight Rates on Electrical Apparatus."

Report, Committee on Finance, John A. Seely, chairman.

Executive session.

Election of officers.

THE LARGEST STORAGE BATTERY IN THE WORLD.

BY C. E. KAMMEYER.

To the Chicago Edison Company and its present executive and engineering staff belongs the honor of having installed and brought to a successful completion the erection of what is now, and undoubtedly will be for some time to come, the largest storage battery in the world, its capacity being equal to 22,640 ampere hours, or some 70 per cent greater than any other battery now in use.

The business growth of the company has been such during the past year that the downtown Winter maximum load increased from 36,000 amperes in 1896 to 44,000 in 1897, and should the present growth continue the Winter maximum of 1898 on the downtown system will be in the neighborhood of 55,000 amperes. In fact, a point had been reached where new investment in either additional machinery or a battery had to be made. The "peak" of the load occurs in Winter time at about 4.45 P. M., and is about 12,000 amperes in height with an average width varying from three-fourths to one and one-fourth hours.

Under these circumstances the installation of a battery became almost a foregone conclusion, and in course of time a contract for the furnishing of such a battery was entered into with the Electric Storage Battery Company, of Philadelphia.

From the point of an investment, the conditions for a battery installation were very favorable, since the current is carried from the Harrison street station to 139 Adams street, the site of the original plant, over a trunk line 3,500 feet in length, and thence distributed. The old Adams street site was therefore a very favorable point for a battery installation, since a large trunk line investment was avoided. Moreover, the center of load of the system has been gradually moving farther away from 139 Adams street, so that for good regulation at time of maximum load in Winter, with feeders varying from 800 feet to 3,000 feet in length, either a booster system or a large outlay in copper had to be considered. The battery filled the situation, being designed to discharge on two voltages, 125 volts to accommodate short feeders, and 140 volts for certain long feeders, although it is equipped with a third end cell switch, so that still another voltage of discharge can be obtained, should future demands necessitate it.

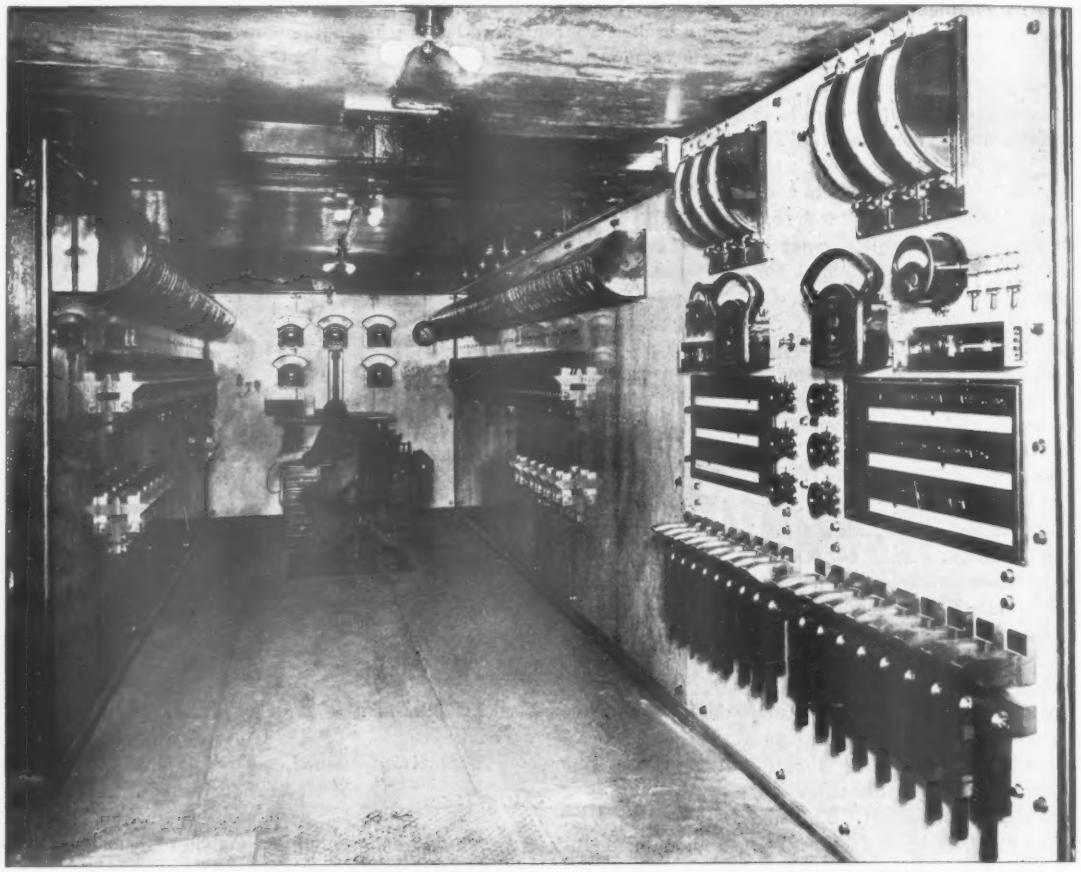


FIG. 1.—"THE LARGEST STORAGE BATTERY IN THE WORLD."—DISTRIBUTION ROOM, EDISON BUILDING, CHICAGO, SHOWING FEEDER SWITCHBOARD AND BATTERY REGULATING SWITCHBOARD

LOCATION.

In selecting a suitable place for the

Electric Lighting in Syracuse, N. Y.

The city of Syracuse, N. Y., will have $100,000 to expend for street lighting since the legislature has authorized the expenditure of an additional $10,000 for this purpose, and the aldermen are already figuring how the money can be expended to the best advantage to their constituencies. The suggestion has been made that the extra $10,000 be expended in ornamental electric lights in the center of the city.

location of such a gigantic combination of storage cells, the question of permanency in every detail was naturally the first consideration, as the size of the installation and the limited area and head room made alterations in the future out of the question.

FIG. 3.—LOOKING DOWN LINE OF CELLS, REAR OF BATTERY-ROOM, SHOWING VENTILATING DUCTS.

After most carefully going over every detail bearing on the question, the basement of the company's office building, 139 Adams street, was selected, but before the battery could be installed, extensive alterations and changes in the way of reinforcements had to be made.

Precautions were taken to see if the footings of the columns supporting the floors above would be sufficient to sustain the weight of a duplicate installation in the future. It was found that new footings were necessary, so the building was temporarily shored up.

The matter of sub-drainage, surface drainage, supports for the cells against ceiling, as the building is not piled and on soft ground, the floor and protection of the columns and iron beams supporting the upper floors of the building, and the ventilation were most carefully considered. A sub-drainage system of three-inch tile pipes, laid in concrete, was installed and surface-drainage lead pipe laid in sand, draining several lead-lined sumpts, and both draining into a large sumpt at the extreme south end of the room, which is emptied by a lead-lined centrifugal pump and discharged into the sewer.

To prevent settling, five four-inch I beams were laid crosswise under the cells, the space between being filled with concrete. Over this a few courses of tarred felt were laid.

The floor is of vitrified shale tile, each 10 inches by 10 inches by two inches, laid in a mixture of 70 per cent of asphalt to 30 per cent of coal tar. The bottoms of the columns are encased in lead. The columns were carefully cleaned, then treated with a galvanic varnish and afterwards encased in wire lathing, covered with an alkaline cement plaster and then covered with a coating of anti-acid paint. All of the walls and ceilings are treated with the same plaster and are rendered impervious to acid fumes. It can be imagined that the quantity of gases given off by a battery of such size is not small, and some means for ventilation had to be devised. For this purpose two ducts on opposite sides were run the entire length of the room, one for blowing in fresh air, the other for exhausting. This affords several cross currents of air and effectually removes the gases, which are conveyed to the roof and blown to the outer air.

Our illustration, looking down a line of cells, shows one of these ducts, it being impossible, by the way, to obtain a photograph showing all the cells, and conveying a proper idea of the magnitude of the installation, on account of the number of columns in the basement.

THE BATTERY.

The battery has a capacity of 22,400 ampere hours, at an eight-hour rate, and will be able to discharge 11,000 amperes for about one and one-quarter hours. It consists of 166 cells (60 of which are end cells), 83 on each side of the three-wire system. This large number of end cells is required to meet the wide conditions of pressure. The battery is called upon to deliver 140 volts on each side at the end of discharge, and in case of an emergency must deliver current at a maximum of 120 volts on each side, when fully charged. Each cell contains 87 plates (known as type "H" in the catalogue of the Electric Storage Battery Company), whose dimensions are 15½ inches by 32 inches. The positives are of the standard Manchester type.

Each tank is 21½ inches wide, 79¾ inches long and 43⅞ inches high, weighing the trifle of 6,200 pounds or over three tons. The total weight of battery, exclusive of conductors, amounts to the respectable sum of 1,029,200 pounds or in the neighborhood of 26 car-loads of 20 tons each. The tanks are constructed of two-inch ash, lined with five-pound sheet lead. They are each supported on 10 double petticoat insulators, resting on tiles laid on the acid-proof floor. An end view of two cells, showing series connection and giving a faint idea of the size of conductors, is given in Fig. 4.

CONDUCTORS.

The main connection of the battery consists of two copper conductors, each six inches by one-half inch, giving a sectional area of six square inches. The end cells are connected to the end-cell switches by lead-covered copper bars, six inches by one-half inch, supported by insulators resting on iron girders strung between the columns of the building. The lead coating of the conductors is a special feature and became necessary in order to guard against the deleterious action of the acid and gases.

FIG. 2.—VIEW OF BATTERY-ROOM, SHOWING END-CELLS AND REAR OF END-CELL SWITCHBOARD.

END-CELL SWITCHES.

There are three end-cell switches

(Continued on page 360.)

The Electric Light Station at Malta.

With a view to extending the electric light in Malta, a 200-kilowatt plant, consisting of a Mordey alternator and Universal single-crank engine, has recently been installed by the Brush Electrical Engineering Company, says our London namesake. The illustration, page 347, shows the plant in position. The installing of this unit raises the capacity of the station to 575 kilowatts, disposed as follows: one 200 kilowatts, three 100 kilowatts, one 50 kilowatts and one 25 kilowatts. A 200-horse-power boiler of the Babcock-Wilcox type has also been erected, making a total of four boilers, all of the same capacity.

The station has been running a little over 16 months, and started from the first with a paying load.

The streets of five towns, including the capital, Valetta, are lighted with incandescent lamps of 32 candle-power. About 65 arcs of the B. V. type are used for lighting the grand harbor and some of the principal thoroughfares in Valetta. These lamps have their own transformers, lowering the voltage from 2,000 to 35. The lighting on this system has given every satisfaction. The above represents about 150 kilowatts of load for street lighting, which is practically maintained the whole night through.

Beyond this, nearly the whole of the War Department buildings and barracks of these towns are connected on to the mains, being equivalent to about 2,500 eight-candle-power lamps. These lamps are alight practically the whole evening till 10.15 P. M., when they come off simultaneously. There have been numerous applications for private consumption, and, now that the new plant is ready, they will be considered, all wiring being carried out by the Maltese Government.

A further extension to a town called Sliema will be carried out this year—about four miles away. The streets here will be lighted with incandescent lamps, with a few arcs along the sea front. Several of the forts and barracks at this place will no doubt be installed with the electric light. The price charged for current for lighting is sixpence per unit.

The Western Electric Company has asked the United States court for an injunction to prevent the Detroit Telephone Company from using the mutiple switchboard. The Detroit company officials assert their device is entirely different in character.

ELECTRIC LIGHT FLASHES.

The officials of the First Presbyterian Church, of Chester, Pa., are talking of putting electric lights into the church, to take the place of gas now in use.

The Trenton, N. J., Light and Power Company will soon commence to lay 70,000 feet of conduits for their wires in the principal streets in the center of the city.

The city government of Providence, R. I., has decided that all electrical wires must go under ground. The matter has been actively agitated for five years.

The plant of the Mitchell, S. D., Electric Company was almost totally destroyed by fire a few days ago, at a loss of $7,000; no insurance. The fire was caused by a spark from the furnace falling on a pile of straw in the engine-room.

The Redlands, Cal., Electric Light and Power Company will hold a called meeting on July 21 for the purpose of considering a proposition to increase the company's capital stock from $200,000 to $500,000, and also to increase the bonded indebtedness to $400,000.

At the regular annual meeting of the stockholders of the Hudson, N. J., Electric Light Company, the following officers were elected: E. D. Mullen, president and general manager; C. R. Rougherty, treasurer; H. M. Francis, secretary; A. K. Bonta, superintendent.

At the annual meeting of the Middlebury, Vt., Electric Company the following officers were elected: President, Frank A. Bond; treasurer, E. P. Cushman; secretary, Delmar W. Smith. Directors: F. A. Bond, T. E. Wells, E. P. Cushman, D. W. Smith, A. H. Bristol, T. D. Wells and William Mathews.

At the annual meeting of the Nazareth, Pa., Electric Light and Power Company the following officers and directors were elected: President, C. Miller; vice-president, J. A. Miller; secretary, J. J. Heintzelman; treasurer, Leslie Williams. Directors: Hiram Koch, Rev. A. E. Erdman, Dr. Thomas Cope, Fred Wunderly and Mark T. Swartz.

The Sedalia, Mo., Electric Railway and Light Company has sold its entire plant to an eastern syndicate for $350,000. F. W. Child, of New York, has been appointed general manager. The electric railway owns 15 miles of track, one park of 40 acres and another of 130 acres, while the lighting plant operates 100 arc and 200 incandescent lights. Extensive improvements are to be made at once.

It is reported that the electric light plant of Rochester, Minn., which has been run for four years, is to be reorganized at an expense of about $10,000 and new dynamos put in to replace the antiquated machines with which the plant has previously been equipped. Larger buildings are to be occupied on the present site, and new boilers will replace those now in use that have been destroyed by four years' work.

The Commonwealth Electric Company, of Chicago, Ill., which is to absorb all the electric lighting plants south of Thirty-ninth street, and operate them as a business ally of the Edison company, now has a capitalization of $1,000,000. It can be increased to $2,000,000 if the promoters decide to issue that much stock, as is hinted. The bonds which it is intended to put on the property have not been floated as yet, but the deal is in every way successful.

It is reported that a syndicate has purchased the plant of the Suburban Electric Light Company, which supplies electric light to Elizabeth, N. J., and all the towns along the line of the Central railroad, between there and Plainfield. The syndicate is composed of Vice-President Garret A. Hobart, United States Senator James Smith and B. M. Shanley. It is said Mayor John C. Rankin, Jr., Comptroller Albert B. Carlton, former Assemblyman William H. Corbin and lawyer Frank Bergen, all of Elizabeth, are also stockholders.

A National Exposition of American Products.

The Committee on Interstate and Foreign Commerce has made a report, recommending the passage of a bill authorizing and encouraging the holding of a national exposition of American products and manufactures especially suited for export, at Philadelphia in 1899. The exposition is to be held under the auspices of the Philadelphia Commercial Museums, which is a public institution receiving financial support from the Philadelphia city councils and the state of Pennsylvania. It is to be hoped that the bill will pass, as such an exposition will be of undoubted benefit to the export trade. Mr. W. P. Wilson, 233 South Fourth street, Philadelphia, is the director of the Philadelphia Museums.

Admiral Dewey and the Manila Cable.

The American naval officers at Manila seem to have known what they were about in cutting the Manila-Hong Kong cable, thus interrupting telegraphic communication between Manila and the rest of the world, observes our London namesake. From what we have heard privately, they grappled and lifted the cable some miles off the town, in comparatively deep water, and buoyed both ends. They wished to stop the Spaniards from communicating from the Philippine Islands; but, as stated in the *Daily Chronicle*, they had no instruments of their own wherewith to establish communication themselves through the cable, and hence the great suspense and inconvenience which were felt in the United States pending the dispatch of the "Hugh McCulloch" from Manila to Hong Kong some days later with news. We hear privately that Commodore Dewey sent ashore and endeavored to borrow apparatus, and also to secure the services of a skilled operator; but both were refused to him by order of the Spaniards. Some interesting and important international questions are involved in the cutting of a submarine cable belonging to a neutral country in war time by a belligerent. In any case, the importance, from a practical point of view, of equipping every war vessel with the simple apparatus necessary for establishing communication through a cable, when need be, is more than evident. With the old marine galvanometer no readable signals could be obtained, but the Sullivan galvanometer, now used in our navy, is adapted for both testing and signaling purposes, and with but a little practice, naval men should become expert in exchanging messages through cables, whenever the occasion may arise. We believe our war-ships now have the means for grappling cables in shallow or moderate depths of water, as well as suitable electrical apparatus.

The *Daily Chronicle* says that the "Eastern Extension Telegraph Company looks to the United States to compensate it for cutting the cable at Manila. But Admiral Dewey did not cut it till the Spanish authorities refused to allow the transmission of American dispatches. Therefore the real interruption of the earning capacity of the cable was due to Spanish action, and Lord Tweeddale had better apply for compensation to Madrid."

A NOVEL FORM OF THERMO-ELECTRIC BATTERY.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, APRIL 27, 1898, BY C. J. REED.

(Continued from page 332.)

When any thermo-electric couple is heated up from a very low to a very high temperature, without any great change in the difference of temperature between the hot and cold junctions, the electro-motive force will diminish with increase of temperature until the neutral point is reached, where it will become zero and change sign. From that point it will increase with the temperature, if the difference in temperature between the junctions does not diminish.

In the case shown in Fig. 5, it is evident that the electro-motive force does not change sign. This means only that in this particular case (carbon-caustic-potash junction) the neutral point, if there be any, lies outside of the range of temperatures employed in this experiment; that is, the neutral point does not lie between 260 degrees and 850 degrees centigrade.

When these facts are all taken into account, the results obtained by Liebenow and Strasser, as far as they go, show that the electro-motive force was produced by and depended upon the difference of temperature between the rod and the electrolyte, except in those cases where they purposely introduced disturbing elements. In such cases they do not describe the details of their apparatus and *modus operandi* sufficiently to enable us to judge what effect upon the temperature of various parts of the apparatus may have been produced by the various gases they introduced in some of their experiments and by closing the crucible with a cover, which would naturally tend to keep the temperature of the rod and that of the electrolyte more nearly alike at the point of contact.

The experiment with the carbon rod and caustic potash was varied by Liebenow and Strasser by substituting for the nickel cup used in Fig. 5, in one case a carbon and in another case an iron cup. The results are exhibited (by inverting the curves of Liebenow and Strasser) in Figs. 7 and 8 respectively, which agree with Fig. 5 in showing that the curve of electro-motive force in the carbon caustic potash couple follows in general the curve of temperature, and that the neutral point of this couple does not lie between 200 degrees and 700 degrees centigrade.

A second group of most instructive experiments with metal rods substituted for the carbon rod (the results of which are exhibited in Figs. 9, 10, 11 and 12) demonstrate in an equally convincing manner that a change in the temperature of the electrolyte produces a corresponding change in the electro-motive force. These curves were also inverted on the temperature curves in the diagrams of Liebenow and Strasser. In Fig. 9, showing the result when a nickel rod and cup are used, there are no less than eight well marked points of flexure in the temperature curve, each corresponding to a similar point in the curve of electro-motive force. Fig. 11 differs from Fig. 10 only in the substitution of caustic soda for caustic potash.

An examination of these four curves shows some very instructive coincidences, among which are the following:

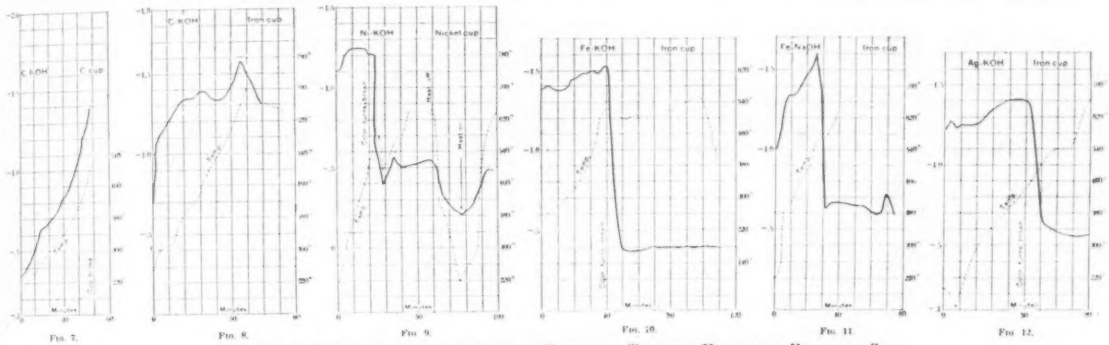
1. The electro-motive force increases with increasing temperature from the beginning of the experiment up to the moment the brown color of the electrolyte appears, indicating a chemical change and probably a condition of dehydration. This change was not marked in Fig. 11 by Liebenow and Strasser, but the curves of electro-motive force and temperature both show that it must have occurred at the end of 26 minutes.

2. When this point is reached there is a sudden and very great change in electro-motive force.

3. Simultaneous with this change of electro-motive force and change of color, an absorption of heat occurs in the electrolyte, which causes a sudden reduction of its temperature. In Fig. 11 this reduction of temperature is indicated only by a flattened portion of the temperature curve. This reduction in the temperature of the electrolyte would necessarily greatly reduce the difference between its temperature and that of the metallic rod to which it communicates heat. It is conceivable that in some cases, where the absorption is very marked and sudden, heat may actually flow back from the rod to the electrolyte. This sudden reduction in the temperature of the electrolyte accounts satisfactorily for the change of electro motive force accompanying it.

4. From this point to the end of the experiment the curve of electro-motive force follows in general the temperature curve.

In all cases except that of silver, Fig. 12, the temperature at which the sudden change occurs lies between 524 degrees and 580 degrees centigrade. The more rapidly the heat is applied, the higher is the temperature at which this change occurs, and the more nearly vertical is the curve of electro motive force at that point. In Fig. 9 the dehydration point was reached in about 23 minutes and the temperature attained before the change was 580 degrees. In Fig. 11 the time was about 26 minutes and the temperature attained 570 degrees. In Fig. 10 the time was 40 minutes and the temperature 524 degrees.



DIAGRAMS ILLUSTRATING "A NOVEL FORM OF THERMO-ELECTRIC BATTERY."

In Fig. 12 the time was 50 minutes, the temperature 460 degrees, and no reduction of temperature was observed to accompany the change of color. This may be accounted for on the supposition that, owing to the slowness of the reaction in this case the continuous application of external heat was sufficient to prevent an actual fall of temperature.

(To be concluded.)

A Memorial Day Souvenir.

The American Electrical Works, of Providence, R. I., are sending to their customers and friends, as a souvenir of Memorial Day, a fine steel-plate portrait of Abraham Lincoln and a slip containing a quotation from his famous Gettysburg address. As usual, the souvenir is appropriate and handsomely prepared.

The Shanghai, China, city authorities recently adopted the following resolution: "That the Council be and is hereby authorized to consider the expediency of establishing a system of electric tramways in the settlement."

THE ELECTRICAL SHOW.

What Occurred During the Fourth Week of the Exposition.

THE SHOW WILL BE KEPT OPEN ANOTHER WEEK, CLOSING ON JUNE 4—NEW ATTRACTIONS INSTALLED—PROMINENT VISITORS ATTEND—PROFESSOR SHORT'S LECTURE.

A number of new attractions were added to the many features of the Electrical Exposition at Madison Square Garden, New York city, during the past week, which was the fourth of the show. At the earnest solicitation of the exhibitors the management has decided to keep the show open another week, making the closing date Saturday, June 4. It is to be hoped that the weather man will provide a few days of sunshine to balance the rainy days of May.

On Monday evening the theatrephone connecting the opera house in Milwaukee with Madison Square Garden was put in operation, to the huge enjoyment of the large assemblage. On Tuesday evening a committee of the officers of the New York State Agricultural Society was present and was shown through the Garden by President Baker and General Manager Nathan. The object of the committee's visit was to arrange for some of the exhibits in the Garden to be transferred to the electrical exposition to be held at the State Fair at Syracuse, N. Y., where there are buildings suitable for the holding of an electrical show.

Gen. Benjamin F. Tracy was the guest of Mr. C. O. Baker, Jr., on Tuesday evening. Among other prominent visitors was Charles R. Huntley, of Buffalo, N. Y., general manager of the Buffalo General Electric Company, and ex-president of the National Electric Light Association. Among the visitors on Wednesday evening was Mr. Alfred F. Moore, the well known wire manufacturer of Philadelphia.

The Moore chapel continues to attract numbers of visitors and is one of the most popular features of the show. On Tuesday evening William Edison, the second son of Thomas A.

(Concluded on page 356.)

Electrical Review

[OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.]

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SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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We are glad to note that the naval appropriation bill makes provision for numerous large electric light and power plants for the different government navy yards throughout the country. The average cost of each plant is about $15,000. There is also an appropriation of $23,225 for a portable electric outfit for the engineer corps.

The importance of Chicago as an electrical manufacturing center is becoming greater each day. The hustling character of the city loses nothing through its electrical representatives.

We call attention to an excellent article in this issue by Mr. C. E. Kammeyer on the largest storage battery in the world. It is installed in the station of the Chicago Edison company and will doubtless be visited by many of those attending the Electric Light Convention at Chicago.

The electric light plant at Mitchell, S. D., was destroyed by fire the other day. The engineer was burning straw for fuel, and a spark fell on a pile of it and set fire to the whole outfit. Is coal or wood too high priced for the Mitchell electric light people, and was straw fuel used for economy's sake? And what profiteth it a man if he burn straw and thereby burns up his electric light station?

One night recently a man giving the name of Joseph Evans, of New Design, Ill., was caught, by means of an electric alarm, robbing the store of Blanke & Son, at Huey, Ill. He was taken to Carlyle, where court was in session, the next morning, pleaded guilty, and was sentenced at once. He spent the night in the penitentiary. It is safe to assume that Mr. Evans is satisfied that electricity moves quickly.

Admittedly one of the chief results of our war with Spain will be the discovery of weak and undesirable parts of the equipment of our war vessels. While it is perfectly certain that complete and accurate technical reports of the behavior of all kinds of apparatus while the ships are in action will be forthcoming from competent and trained observers after the war is over, we hope that the reports regarding the comparative performance of hydraulic and electric turret-turning gear will be especially full and accurate. From the standpoint of the electrical engineer the advantages of the electric over the hydraulic system are paramount.

THE ELECTRIC LIGHT CONVENTION.

The event of the year for the electric lighting interests of the United States occurs next Tuesday, when the twenty-first convention of the National Electric Light Association begins its sessions in the Auditorium Hotel at Chicago.

The programme for the business sessions is an excellent one, including addresses, discussions and lectures of practical value to the central station man. The entertainment programme, which will naturally be carried out with true western hospitality, is equally attractive in its way.

The attendance, especially from the central and western states, promises to be all that can be desired. There will be a considerable delegation from New York, Boston and other eastern cities, and if the number warrants, a special train through to Chicago will be run from New York city.

Those of our readers who have not fully informed themselves of the convention arrangements will find full information on another page of this issue of the ELECTRICAL REVIEW.

X-RAYS IN WARFARE.

Cable dispatches from London inform us that the first reports of the use of the Roentgen rays in warfare were made on May 20 at the United Service Institution by Surgeon Beevor, who described the results of their use in the recent frontier campaign in India and gave lantern views. Many important cases consisted of bullet wounds received by officers and men who were injured in the bones, joints and internal organs. Their injuries but for the X rays would have resulted in the amputation of limbs and probable loss of life. In all the instances enumerated the bullets were, by the use of the X rays, successfully removed, the men subsequently rejoining their commands. The portable apparatus weighs 80 to 100 pounds. It is understood that the United States Army is to be equipped with portable X-ray outfits, and that the order for a considerable number has already been placed.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

With the exception of some buying Tuesday, based on the reports that our fleet had succeeded in destroying the Spanish war ships, the public has staid away from the Stock Exchange. The securities markets have, however, ruled very strong, and values have either advanced or at least held their own. This condition of affairs has been due principally to the efforts of prominent financial and speculative interests to infuse into the markets a semblance of strength, in the hope that the general public would be led to operate more actively by the apparent elimination of the war as a depressing factor in speculation.

General Electric opened at 36, sold up to 37 on Wednesday and fluctuated within a one-point range during the remainder of the week, transactions being on a moderate scale. The report that the contract for the Manhattan equipment had been awarded to the company is officially denied. Is is not expected that any definite steps will be taken in the matter for some little time yet.

Western Union was steady throughout the week at 90¾ to 91¾. Some of the latest test-office receipts show a falling off, which is attributed by the officials to the fact that press business has been greatly curtailed since the establishment of the censorship by the government.

North American was very quiet at 5⅝ to 5⅞. There was a transaction in American Telegraph and Cable at 92.

Edison Electric Illuminating of New York bonds were unusually active this week. Sales of the consolidated 5's were heavier than in a long time, and the price advanced from 116 to 118.

The statement of the Brooklyn Edison Company for April shows gross earnings of $73,590 and net of $31,413, an increase in the latter of $544 over 1897. Deducting taxes, etc., the net result shows an increase of only $144 for the month. The net result for the year to date is $133,284, an increase of $5,203 over the corresponding period of 1897. It is understood that $500,000 of the new stock of the company will be issued shortly in the form of rights to stockholders at par.

There was only moderate trading during the week in electrical stocks on the Boston Stock Exchange. American Bell Telephone opened at 259, and on limited dealings rose to 268, closing at that figure. Erie

Telephone ranged between 68 and 69, closing at 68@68½. New England Telephone was bid 130, offered at 133; Westinghouse common, 22@23, and the preferred sold at 53@53½, closing at the latter figure.

The only electrical stock dealt in on the Philadelphia Exchange during the week was Pennsylvania Manufacturing Light and Power Company, which opened at 13⅞ and subsequently sold down to 13½. Electric Storage Battery common was quoted at 22@23¼, and the preferred at 24@25. It is reported from an official source in Philadelphia that the proposition to take the Northern Electric Light Company into the Pennsylvania Manufacturing Light and Power Company on the terms already published in this column has been accepted by the controlling interests on both sides, and the transaction has become an accomplished fact. Security holders have not as yet been formally notified. The Northern Electric Light Company was incorporated in 1885, has paid regular dividends of 10 per cent since, and owns free and clear its property in Philadelphia. RAY.

Wall street, May 28.

ELECTRICAL CONVENTIONS.

DATES OF FORTHCOMING ELECTRICAL MEETINGS AND CONVENTIONS.

National Electric Light Association, twenty-first convention, Auditorium Hotel, Chicago, June 7, 8 and 9.

Northwestern Electrical Association, annual convention on lake steamer from Chicago to Duluth, June 10, 11, 12, 13 and 14.

American Institute of Electrical Engineers, general meeting, Omaha, Neb., beginning June 27.

Canadian Electrical Association, annual convention, Montreal, June 28, 29 and 30.

Philadelphia Electrical Exposition, Philadelphia, will be held during the entire month of June.

Trans-Mississippi and International Exposition, Omaha, Neb., June 1 to November 1.

The Association of Railway Telegraph Superintendents, annual convention, Omaha, Neb., June 15.

Among the interested visitors at the Electrical Exposition in New York city last Saturday evening was Mr. Ronald T. McDonald, president of the Fort Wayne Electric Corporation.

NORTHWESTERN ELECTRICAL ASSOCIATION.

ARRANGEMENTS FOR THE CONVENTION.

The arrangements for the annual convention of the Northwestern Electrical Association, which will be held on the lake steamer between Chicago and Duluth, from June 10 to 14 inclusive, are going rapidly and successfully forward. Mr. J. M. Hill, chairman of the committee on arrangements, has been informed by Professor Fujioka, of Tokio, Japan, who is now in the United States as a special emissary of the Japanese Government, that he will be present at the meeting. It is also expected that Mr. William Stanley, of Pittsfield, Mass., and Mr. Charles F. Brush, of Cleveland, Ohio, will attend. Mr. J. E. Powell, inspector of electric light plants for the Treasury Department, has also signified his intention of being present at the convention.

Mr. W. S. Horry will read a paper entitled "The Electrical Smelting of Ores." This will form the basis for a general discussion to follow the address. This matter is one of importance to Duluth, as iron ore can be obtained in that vicinity at a very low cost, and there is plenty of available water power for generating the electric current. Mr. Horry's address and the resulting discussion promise to be of importance and value to the iron smelting industry. The final programme for the meeting has not yet been fully decided upon, but will be announced at an early date.

Prof. Elisha Gray, of Chicago, and Mr. W. S. Mallory, who is associated with Mr. Edison, have been invited to attend the convention as honorary guests.

A Self-Charging Electric Motor Car.

Mr. L. Epstein has recently patented a new electric motor car, in which he claims to have overcome the difficulties presented by batteries becoming exhausted at a distance from a charging station, says the London *Electrical Review*. It is admitted that it is one of the great drawbacks of the electric motor cars that the batteries require periodical recharging, this necessitating the existence of charging stations, and considerable rough usage of the accumulators in taking them out for charging and putting back in position again. These drawbacks are said to be avoided by the Epstein motor car, which is self-charging, inasmuch as it is equipped with the necessary apparatus for automatically charging the cells whenever and wherever required, with very little difficulty. The car is equipped with Epstein cells of a special type and an oil engine, and the motor can be reversed for use as a dynamo for the purpose of charging the cells. The extra equipment is stated to be responsible for an additional weight of only three per cent, compared with the ordinary electric motor car. The weight of a self-charging car, complete with all equipment and four passengers, comes out at something under 30 hundredweight. The accumulators weigh seven hundredweight, and are considered sufficient for a 60-mile run on ordinary roads. We understand that Mr. Epstein now has one of the cars in course of construction.

New York Electrical Society.

The annual dinner of the New York Electrical Society was held at the Hotel St. Denis, New York city, last Friday evening. About 100 members and guests were present. Mr. T. C. Martin acted as toastmaster and the following were the speakers of the evening: President Gano S. Dunn, Prof. F. B. Crocker, Joseph Wetzler, Capt. E. L. Zalinski, Dr. William McMurtrie, Stephen L. Coles, Frank W. Jones, H. Ward Leonard, C. O. Mailloux and H. B. Coho.

Mr. George H. Guy, secretary of the society, played some original compositions on the piano and a number of patriotic songs were sung.

The annual meeting of the New York Electrical Society was held at Madison Square Garden on Thursday, May 26, instant. The following officers were elected: President, Gano S. Dunn; vice-presidents, Willard S. Case, H. B. Coho, Dr. C. A. Doremus, F. A. Pattison, E. E. Higgins, Charles Blizard; secretary, Geo. H. Guy; treasurer, H. A. Sinclair.

The treasurer's report shows the society is in a prosperous condition. According to the secretary's report the membership last year was 397; there have been 215 members elected this year; there have been four resignations and one death. There are now 607 members in the society. At the annual meeting 37 members were elected, including Messrs. F. W. Roebling and H. L. Shippy.

Dr. Charles E. Emery, the well known consulting engineer, of New York city, is lying dangerously ill at his home in Brooklyn, N. Y.

PERSONAL.

Mr. A. J. DeCamp, the well known Philadelphia electric light man, made a brief visit to New York last week.

Hon. Fred W. Royce, the jovial electrical magnate, of Washington, D.C., honored his metropolitan friends by visiting New York city last week.

Mr. Charles R. Huntley, general manager of the Buffalo General Electric Company, Buffalo, N. Y., was among the visitors to New York city last week.

Mr. David J. Jenkins, chief electrician of the Pennsylvania Steel Works, has been assigned to the monitor "Amphitrite," with the rank of assistant engineer.

Mr. E. W. Rockafellow, of the Western Electric Company, has been commissioned captain of Company M, Forty-seventh Regiment, N. G., N. Y.

At the recent annual meeting of the New York Electrical Society four honorary members were elected, as follows: Lord Kelvin, Dr. Roentgen, A. Mascart and Prof. Elihu Thomson.

Mr. E. W. Little, former general manager of the Interior Conduit and Insulating Company, is now a member of the staff of Nicoll, Herrick & Berg, bankers and brokers, of New York. A branch office has been opened in the Townsend Building, Twenty-fifth street and Broadway, in charge of Mr. Little, where his many electrical friends can drop in and see him at any time between 8 A. M. and 6.30 P. M.

Mr. Frank S. Hastings, of New York, brother-in-law of E. C. Benedict, the banker, and a director of the General Electric Company, is in a very painful condition at his Summer residence in Indian Harbor as the result of an explosion of acetylene gas last Sunday. Mr. Hastings went down to his wine cellar with a lighted match in his hand early Sunday morning. A heavy explosion occurred, and he was thrown to the floor. His face and body were badly burned. The house is lighted by acetylene gas, and it is supposed that it had been leaking in the cellar some time, as this was the first time the cellar had been opened since last Fall. The ELECTRICAL REVIEW was informed on Tuesday morning that Mr. Hastings had passed the previous night comfortably and expected to be about again in three weeks.

A CHICAGO TELEPHONE MANUFACTORY.

THE STERLING ELECTRIC COMPANY'S TELEPHONE EXCHANGE APPARATUS.

In the earlier days of telephone engineering, the "engineering" features consisted very often in renting the back portion of some drug store or other convenient place, putting up an annunciator, with as many drops as there were subscribers or likely to be, connecting up the lines, and with the aid of a half dozen jacks and cords that could be cut into any two lines, and depending upon luck and the non-interference of the elements for a satisfactory service. In those days the patient subscriber was easily satisfied. If, after three or four minutes' waiting, relieved by an occasional twirl of the magneto, he finally succeeded in making Dr. Jones understand that he was wanted at Smith's house, Smith would hang up the receiver and remark: "This telephone is a great thing," and so it was.

The experienced manager of to-day, in building an exchange, is confronted with conditions quite different from those obtaining 15 years ago. The ordinary annunciator and jacks have developed into an elaborate switchboard, with numbers running into the hundreds and thousands; automatic devices for transferring, clearing out and other purposes are provided. Protective appliances of various design guard against damage from lightning and other destructive currents. The subscriber of to-day wants next to instantaneous service, and he comes pretty near getting it.

Among the latest appliances developed for the equipment, operation and protection of a modern telephone exchange, the various devices some time ago placed upon the market by the Sterling Electric Company, Chicago, deserve special mention, and a brief description of them can not fail to prove interesting.

The switchboard may be aptly termed the heart and soul of an exchange, and upon its perfection, efficiency and proper operation depend the quality of the service in general. The main points of construction, arrangement and operation of the switchboards of to-day being alike in many respects and generally understood, it would be superfluous to enter into a detailed description of this one.

The illustration, Fig. 1, shows a 500 metallic line board, with the Beach-Cook transfer system arranged beneath the jacks and the distributing board located to the left of the switchboard proper. It will be noticed that the latter is composed of five sections of 100 drops each, which are, of course, duplicates of each other. Additional sections can be added from time to time as required. This is a feature adopted by the Sterling company from the start, possessing many advantages over

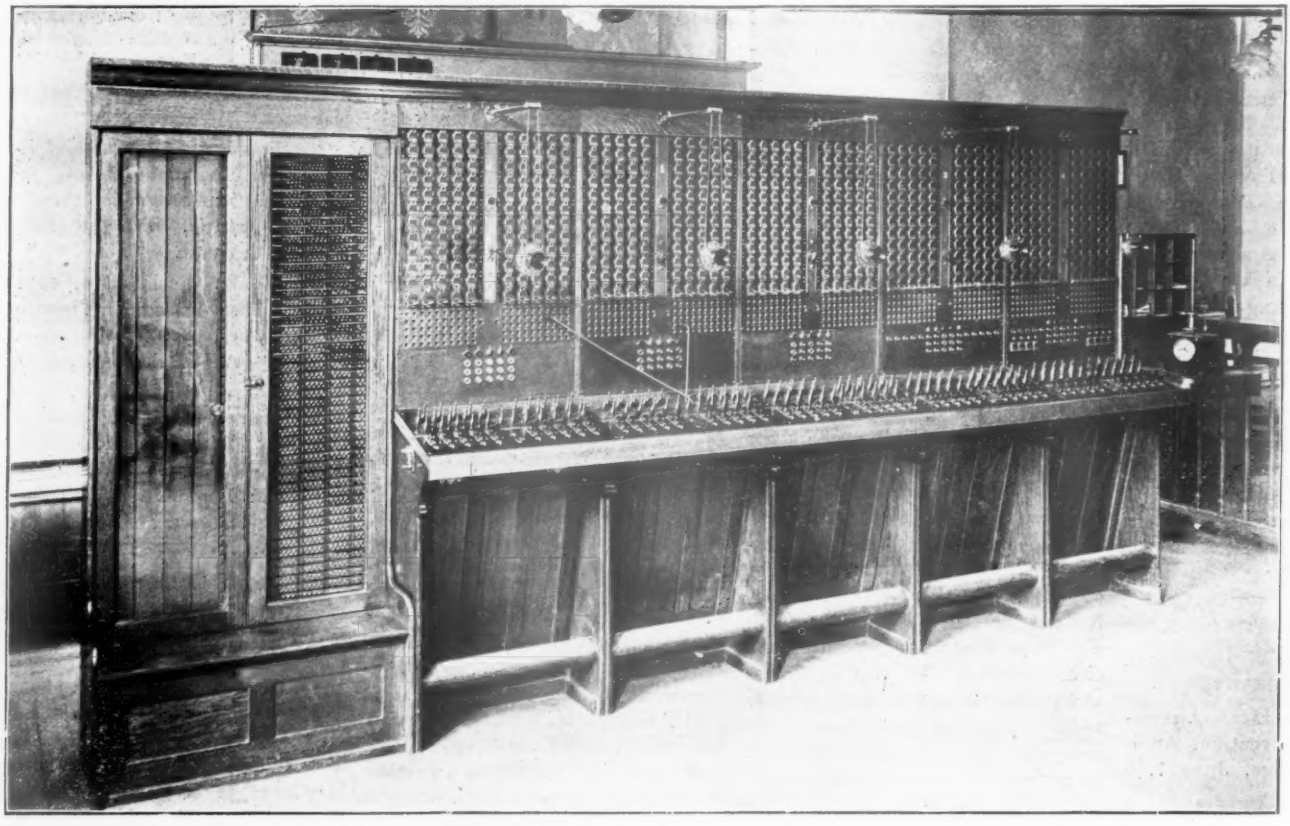


FIG. 1.—500 METALLIC LINE SWITCHBOARD, SHOWING TRANSFER SYSTEM BENEATH JACKS AND DISTRIBUTING BOARD ON LEFT.

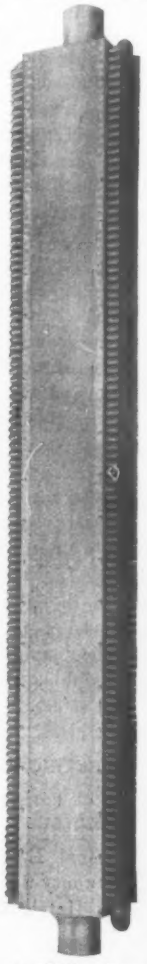


FIG. 4.—200-WIRE COMBINED TERMINAL AND PROTECTOR.

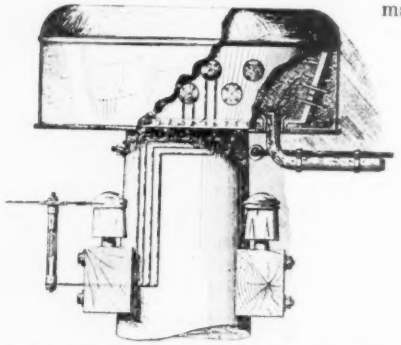


FIG. 7.—DETAILS OF POLE-TOP TERMINAL AND LINE FUSE.

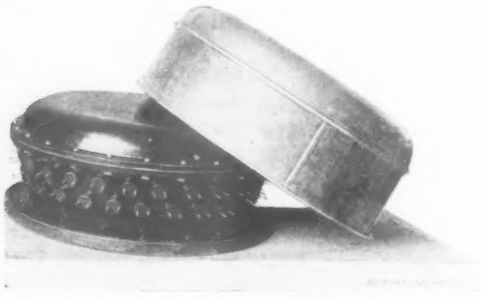


FIG. 6.—VIEW OF POLE-TOP TERMINAL, COVER REMOVED.

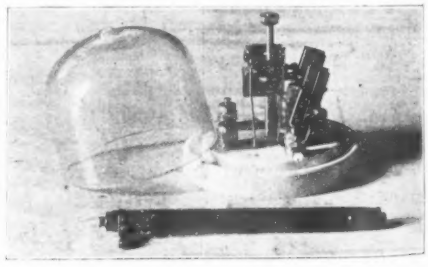


FIG. 3.—LINE FUSE AND INDIVIDUAL SUBSCRIBER'S PROTECTOR.

boards of a definite capacity, which in case of a desired extension will either have to be duplicated or exchanged for larger ones.

The drops are of the tubular type, which makes them absolutely non-inductive and insures freedom from cross talk. They are mounted in strips of five on a metal plate, which plates in turn are mounted within the board in a manner which gives two panels 10 drops high by five in width for each section, a hardwood strip separating the two banks. The drop board is equipped with the Cook drop-restoring device, which restores every drop down in each bank of 10. The night-bell attachment of the drops is positive in action and is made by a brush contact $\frac{1}{32}$-inch wide, which always insures absolute service. The jack board is placed immediately under the props. It is made of hardwood, fiber-faced, and is mounted with 100 brass jacks equipped with german-silver springs. Right under the line of jacks are placed the order keys for the automatic transfer system, as well as the jacks necessary for quick service between different sections of the board. Ten pairs of cords are provided for each keyboard, the cords having 20 metallic standard plugs. There are also 10 transfer cords with plugs, 10 combined ringing and listening keys, and 10 order buttons for the transfer service. The portion of the keyboard immediately under the plugs is covered with very heavy leather to deaden the sound of falling plugs and also to prevent wear. The cords run through pulleys which run along guide wires, guarding against twisting and tangling. Each board is equipped with an operator's cut-out and plug, Cook transmitter support and powerful hand generator. The cabinet work can be furnished in oak, cherry or natural wood, according to the taste of the patron, or so as to harmonize with surrounding fittings.

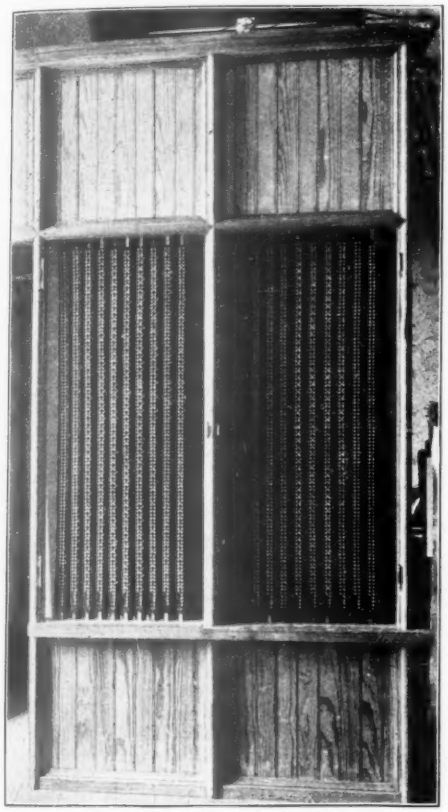


FIG. 2.—DISTRIBUTING BOARD

The distributing board, a separate view of which is given in Fig. 2, is placed in a cabinet at one end of the switchboard proper, and is made up in strips of 50 metallic circuits each. It consists of hard rubber, hardwood and brass, each strip being 48 inches long, three inches deep and two and one-half inches wide. It is very compact and complete.

While the efficiency of an exchange depends, as has already been stated, upon the complete and adequate inside equipment, the service would be subject to frequent interruptions without a thorough system of protective devices, which will guard against interference from lightning, electric light currents and other disturbing elements. Probably few companies can show as complete and carefully worked-out line of protective appliances as the company mentioned.

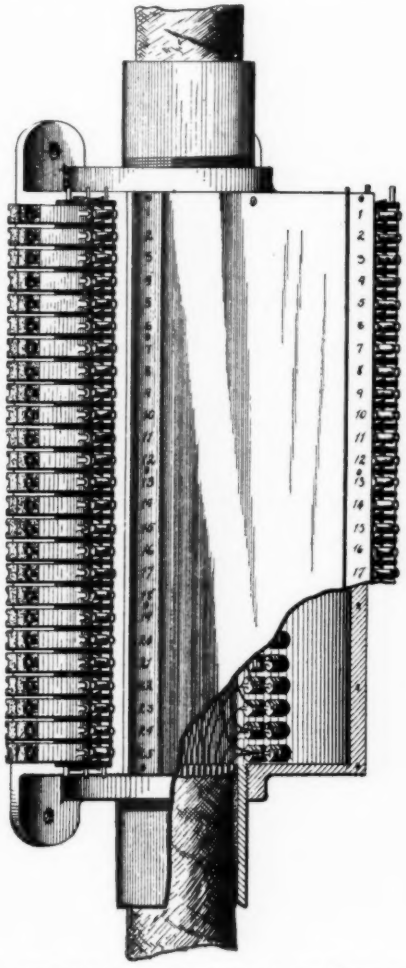


FIG. 5.—DETAILS OF CABLE TERMINAL AND PROTECTOR.

In Figs. 3 and 4 is shown a combined cable terminal and protector, used as the inside terminal of the cable. It is made of an iron casting, on the inside of which are arranged two rows of double binding posts, or connectors, the back row of posts receiving the cable ends, while the front row leads to the distributing board. These binding posts or connectors continue through the casting and have a connection upon the outside.

From the outside point of the back connectors, a branch is taken to a spring in contact with a block of carbon. This block is separated from another similar block by a perforated mica plate. The latter carbon is held in place by a spring connecting with ground, the surfaces of the two carbons being separated only by the thickness of the mica, which is .005 of an inch. This branch circuit, including the carbon blocks, constitutes the lightning arrester. Imbedded in the surface of each of the carbon blocks is a small metal or carbon ball held in position by easily fusible wax. The passage of a current of a high potential from one carbon block to the other creates an arc, which heats the carbons in a few moments sufficiently to melt the wax and release the balls, which fall by gravity, thus leaving a direct connection between the two blocks of carbon. This is one of the features of the strong current protector. From the same connectors the main circuit passes to the line spring, thence through a heating coil to another spring, which is connected to the wire leading to the distributing board. This heat coil is composed of a number of windings of german-silver wire upon a V-shaped metal spool, which is in two parts, united by fusible solder. Upon the passage of even a very slight current, such as .16 ampere, the coil becomes heated,

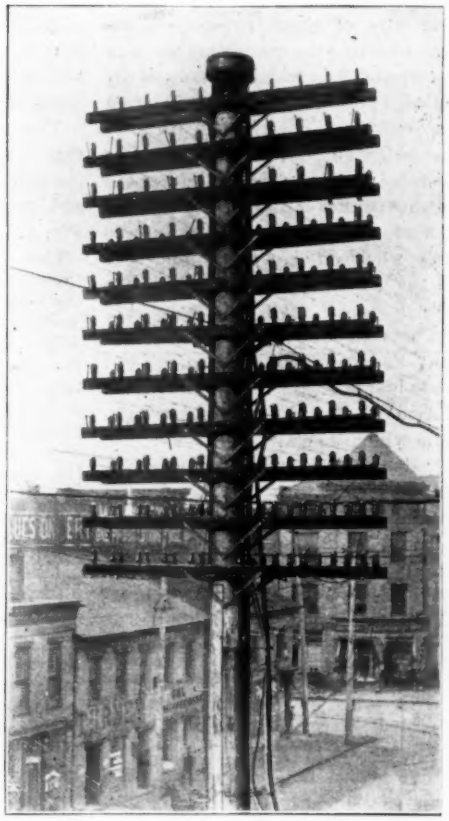


FIG. 8.—TERMINAL POLE FOR 100 WIRES.

the solder melts and releases the two parts. This allows the two springs to fly back and make connections, the line spring direct to ground, while the spring on the switchboard side closes a circuit which automatically sounds an alarm and calls attention to the break. This is the sneak-current feature of the protector.

To protect the cable itself against injury a line fuse is provided. It is a pair of connectors mounted upon either end of a piece of enameled wood tubing about four inches long and one-half inch in diameter. A fuse wire of about five-ampere capacity uniting the connectors through the wooden tube which is hermetically sealed prevents any damage from the weather. This fuse is placed at the outer end of the cable and is operated by the action of either the sneak-current or the strong-current protector, which causes the fuse to blow whenever a current dangerous to the cable passes over the line fuse.

The reliability of this device was fully demonstrated by a recent test made by the Electrical Bureau of the National Board of Fire Underwriters, from which we quote as follows:

"Heat coil test with 110 volts.

"Coil No. 1 with .3 ampere, operated in 26 seconds.

"Coil No. 2 with .3 ampere, operated in 25 seconds.

"Coil No. 3 with .22 ampere, operated in 55 seconds.

"Coil No. 4 with .15 ampere, did not operate in five minutes.

The line fuse in wooden tube operated successfully at about five amperes.

The cable head being equipped with similar heat coils as the protector operated in the same manner, grounding the line onto the cast-iron frame.

Tho pole-top terminal is made up in sizes of 25 to 100 pairs of wires, is of solid iron in three parts and circular in form. It is placed directly upon the top of the pole, which has first been sawed square. The cable is brought into the terminal from the bottom, the lead cover being stripped back and the wires spread to connecting points. These connections appear upon the inside of the terminal through hard-rubber bushings and correspondingly upon the outside of the terminal. The bushing is secured through the terminal in a permanent and air-tight manner, the connections through the bushings being numbered consecutively upon the bottom piece of the iron casting. From the outside connection upon the rubber bushing a spider wire is carried to the line wire upon the cable pole. The cable in the terminal, where it comes into the same, is soldered in place. A rubber gasket is used to make an air-tight joint between the body casting and the lid casting of the terminal. Outside and over all of this is a one-piece copper cover which fits down closely over tho entire terminal, being held into place by the rubber gasket, making it absolutely safe from any weather.

Before sealing either the terminal and protector or the pole-top terminal, there is placed within the case four or five pounds of quick-lime which absorbs every particle of moisture within the terminal.

The neatness and compactness of this style terminal, as compared with the old-fashioned cable box, platform and railing, are clearly shown in Fig. 7.

One of the most important and interesting features connected with the operation of a large board is no doubt the automatic transferring of calls from one section to another. Its perfect operation contributes largely to a satisfactory service and, as a prominent exchange manager remarked, prolongs the manager's life. In the Beach–Cook system, the disposition of a call is as follows: Say subscriber No. 1 upon the 0 board calls for subscriber No. 999 upon board 9. Operator 0 presses order button to board 9, calling for 999, at the same time inserting the remaining plug of cord, with which she answered subscriber 1's call, into a jack that leads through a trunk line to board 9. This drops a shutter upon board 9, which is placed immediately over and corresponds with the cord and plug upon that board. Operator 9 takes the plug designated by the falling of the shutter and inserts it in a jack corresponding to subscriber's shutter No. 999. The circuit is then established for telephonic communication between No. 1 and No. 999. When through talking, either subscriber ringing off drops a shutter upon 0 board, signifying to 0 operator that the service should be discontinued. The 0 operator takes down both plugs of the pair cords used in the connection. This act automatically drops a shutter in connection with cord and plug in jack 999, thereby signaling to operator 9 that cord is to be removed. Should, however, through the carelessness of operator 9, the cord remain and the shutter be restored, subscriber 999, wishing to call central again, in so doing will drop his own drop and also a "hang-up drop" in connection with the transfer system, which at once notifies the operator at 9 board of her negligence, and also that the subscriber is calling for another number. It is claimed that with this system there is no possibility of error through false service.

THE ELECTRICAL SHOW.

(Continued from page 351.)

Edison, arranged in the chapel a phonograph which reproduced part of a church service, consisting of a psalm, a prayer and extracts from a sermon. The phonograph will be heard every day in the chapel hereafter until the close of the show.

During the week the following meetings of the National Association of Stationary Engineers were held: May 23, Nos. 32 and 47 New York; May 24, No. 1 New York; May 25, No. 55 and No. 41 New York; May 26, No. 44 New York; May 27, No. 25 New York.

On Thursday evening Prof. Sidney H. Short, of the Walker Company, Cleveland, Ohio, delivered a lecture on "Electricity as a Motive Power for Railroads." An abstract of his remarks appears below:

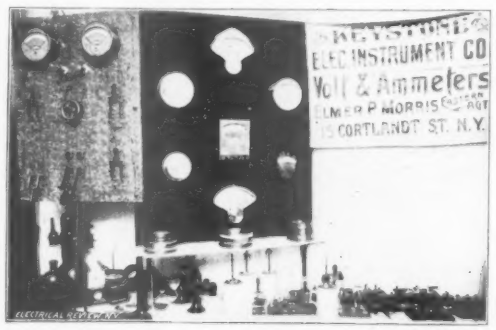


EXHIBIT OF THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY AT THE ELECTRICAL EXPOSITION, NEW YORK CITY.

"This subject is of great interest at this time because of the adoption of electricity by the Brooklyn elevated roads and the careful investigations now being made of the subject by the Manhattan Elevated Railway Company. There are two reasons for the adoption of electricity by elevated railways—one to reduce the cost of operation, the other to increase its schedule speed to the utmost limit.

"The cost of operation can be materially reduced, as fully one-half of the fuel will be saved on account of the cheaper grade of coal which can be burned under stationary boilers, the tonnage remaining the same. The increased rapidity in the movement of the trains will for the same service reduce the train crew wages by a large percentage. The repair expenses of the electrical equipment will show a large annual saving over the repairs required by locomotives. The decrease in the running time of the trains must be made principally by stopping and starting them more rapidly.

"The method to be used on the Brooklyn roads is to use two small motors on each car of the train, making 10 motors instead of four, all of the motors to be controlled from the front platform of the train. Even with this method, known as the multiple unit system, it is not possible to make more than an 18-mile schedule on ordinary elevated railways with one-third mile stops.

"The most serious problem in connection with the operation of trains by means of electricity over long distances is the economical transmission and distribution of the electric current from the main power station to the moving trains of the system. No very long lines have yet been electrically equipped, owing to the cost of transmitting the power. It is not practical to use a higher pressure than 500 or 600 volts in the third rail. The cost of the copper feeders for transmitting power at this pressure to great distances is prohibitive.

"There is, however, another way out of the difficulty. The power stations can be provided with large generators of the alternating-current type, which will produce the electrical energy and deliver it at high pressure to transmission lines, the current quantity being correspondingly small. The high-tension alternating current must be reduced in pressure at intervals along the road and fed into the third rail at the normal pressure of 500 volts. This can be done by means of the ordinary static stepdown transformers, but they would feed the trolley rail with an alternating current which would not drive the current motors on the cars. It is therefore necessary to interpose between the secondaries of the static transformers and the third rail a rectifier or rotary converter which changes the alternating current into a direct current.

"It is only recently that these rotary converters have been developed, and we believe that the great success being attained by this new machine will stimulate the adoption of electricity for long-distance, high-speed railways, and that, in a few years, we will see electric trains operated over lines 100 or even 200 miles in length."

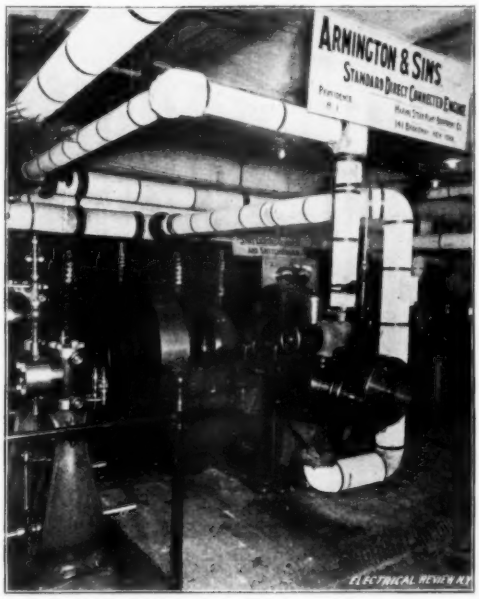
EXHIBITION NOTES.

Broomell, Schmidt & Company, Ltd., exhibit an "American fuel economizer" of 400 horse-power capacity. This is, practically speaking, a feed-water heater that heats the water for boilers with the waste fuel (heat) gases after they leave the boiler setting. This machine is quite an improvement over the old style, every tube can be withdrawn and replaced with a new one in 30 minutes without disturbing any other part of the machine; all inside surfaces are accessible, every scraper can be taken out and replaced; all connections of scraping gear are on the outside of tubes, and hence easily gotten at. The motion of the scrapers is positive. Flat link chains are run

over sprocket wheels, hence no slippage of same. Scrapers are connected up in parallels and balance each other and require very little power to move them. The adaptability of this machine for steam plants is a strong recommendation. The manufacturers claim a saving in fuel of from 10 to 25 per cent according to conditions, and that the average saving is about 15 per cent. The machine shown in the ELECTRICAL REVIEW is in running operation and complete order.

The Faries Manufacturing Company, of Decatur, Ill., manufacturers of the Faries universal adjustable electric lamp holders, aluminum and steel electric lamp shades, and fire and water tube boiler cleaners, have recently established an office at 136 Liberty street, New York city, under the management of A. W. Koenig. Mr. Koenig has arranged a very attractive and interesting exhibit at the Electrical Show, which is illustrated in this issue. The exhibit is located on the promenade just above the main floor, adjoining the New York Telephone Company's theatrephone exhibit. The placing of the Faries universal adjustable electric lamp holders before the public meets the long-felt want of being able to get your light just where it will be of service to you, both in reading and working. Some of them are adjustable in four or five places, so that it is very easy to arrange them to throw light anywhere by merely adjusting the fixture at any angle necessary. These fixtures are manufactured of the finest material, and the best of workmen are employed by the firm. They are made in about 30 different designs of portable and stationary desk and table lamps, side wall fixtures, chandeliers, pendant hall lamps and dental lamps. They are all very unique and attractive in design, while not at all elaborate, thus making the cost very reasonable. The aluminum and steel electric lamp shades or reflectors are made in three styles. They are not only shades, but reflectors of the highest order. The holder reaches well over the shank of the lamp, leaving the shade to begin at the top of the filament, thus enabling a smaller shade of same angle to cover the lamp, as well as a larger one with old style of holder. Being smaller, it is lighter and less in the way; being lighter it is easier to handle and to be borne by light fixtures at different angles, and is not apt to rack or pull the socket as heavier shades are. They fit any socket. They are seamless, and are made both of steel and aluminum; both are enameled either black or green outside, and the steel ones are finely enameled white inside, while the aluminum ones are highly polished inside. The parabola has the further advantage of throwing the light from the side of the lamp, which gives evener illumination, and as the holder swivels on the socket, the shade can be turned to throw the light to any angle. The advantage of the fire and water-tube boiler cleaner, manufactured by this firm, is that it expands when shoved forward in the tubes and collapses when pulled backward so that it will never get stuck. It is easily adjusted for variations in sizes of tubes, and has a ram which enhances the ease and facility of operation, especially when tight and uneven places in the tubes are encountered. There is no leather or rubber about the cleaner, and it does the entire work without the use of steam or water.

The showing of the Keystone Electrical Instrument Company, of Philadelphia, which has been previously briefly described, is one of great interest to the practical electrician, as the instruments shown by this company embody the most improved theories and methods for all electrical measurements and calculations. The "Keystone" instruments have been made for many years, but it is within the past few years that they have been entirely reconstructed by Mr. J. F. Stevens, who devoted some years of most careful laboratory study, which was only possible to one of ample means and intense enthusiasm for the subject. The result of this application is evident in the improved "Keystone" instruments, and the large number of new characters of instruments which have been perfected and are now standard. The accompanying illustration shows on a switchboard made by the Technic Electric Works, of Philadelphia, several of the most important instruments.



ARMINGTON & SIMS DIRECT-CONNECTED ENGINE SHOWN AT THE ELECTRICAL EXPOSITION, NEW YORK CITY.

EXHIBITS OF ADAMS-BAGNALL ELECTRIC COMPANY AND ELMER P. MORRIS AT THE ELECTRICAL EXPOSITION, NEW YORK CITY.

The exhibit is in charge of the New York manager, Mr. Elmer P. Morris. It includes a direct-reading arc voltmeter, having a scale up to 6,500 volts fitted with a ground detector so that the exact location of the ground on the line can be found by two readings. The standard types of illuminated dial instruments are arranged with small incandescent lamps before the dial, with the idea of avoiding shadows. The "Keystone" wattmeter, voltmeter, ammeter, portable, direct and alternating-current voltmeters are also shown.

A new arc lamp, known as the "Toledo," which will soon be placed on the market by Messrs. J. Jones & Son, New York, has attracted the attention of students of progressive electric lighting. The construction has some features which are worthy of description, prominently the fact that no magnet is used in the controlling mechanism, this being obviated by the use of thermal expansion for the movement of the clutch. Several wide bands of alloy, possessing great thermal expansion co efficient are connected by whiffletrees, so that the expansion of the three is cumulative and finally connected to the clutch by a multiplying lever giving a ratio of about 10 to 1. The straps are 14 inches long, with a conductivity equal to that of No. 24 copper wire. The total expansion from the atmospheric temperature to the running temperature is approximately one-eighth of an inch. The clutch works on the carbon, giving the "sneak" feed system. The lamp can be used on alternating or direct-current circuits, and in fact can be switched from one to the other with no change in adjustment.

In the way of power-generating plant the installation of the Armington & Sims Company, Providence, R. I., has had a large share of attention. The equipment, as shown in the exposition, is of a 90-horse-power engine, 13 by 12, of the horizontal type, operating at 90 pounds pressure, 275 revolutions per minute. A gravity-feed oiling system for the crosshead slides and crank-pin, and new snap-packing rings in the piston valve—also the "Rites" governor—are features of the engine. Connected to it is a 50-kilowatt, direct-connected, 125-volt Walker generator.

Electrical Progress in Japan.

Professor Fujioka, formerly of the University of Tokio, in his recent lecture before the New York Electrical Society, stated that during 1896, 22,000,000 telegraph messages were sent in Japan, and there were six telephone exchanges, with 3,232 subscribers. At the present time there are 40 central electric lighting stations, and the number is increasing. Several power transmission enterprises are being put on foot, and the waterfalls of Japan are numerous, while coal is scarce and dear. There are now two electric railroads operating in Japan, and about 200 miles is projected for early construction.

The report of the Mexican Telephone Company for March shows:

	1898.	1897.	Inc.	Dec.
Gross	$11,067	$10,389	$678	
Net	3,585	4,308	....	$722

Subscribers, 2,543; gain, 188.

ELECTRIC FISHES.*

BY W. W. KNIGHT.

One of the most peculiar and interesting of the phenomena of nature is the faculty which some fishes possess of giving off at will more or less powerful electric shocks. Although some of these fishes have been known from times as early as the days of Pharaoh, it is only within recent years that they have been given any special study. The shocks are given from living electrical batteries especially formed for that purpose. A careful study has been made lately of these organs, which have been found to be apparently without insulators, regulated by the nervous system, and under the direct control of the animal. About 50 species of fish possessing these electric organs have been found, but only three varieties are of any particular interest. These are the torpedo, which belongs to the skate family, and which is quite common in the Bay of Biscay and the Mediterranean Sea; the gymnotus, or electric eel, found in all the streams which flow into the Orinoco, and the malapterurus, or the thunderer-fish of the Arabs, a native of the Nile and other African rivers.

There are two distinct types of electrical organs. One is closely related to muscle in its structure, and is found in the torpedo and gymnotus, whereas the other has more of the characteristics of a secreting gland, and is illustrated in the thunderer-fish. Both types are made up of a vast number of minute microscopical elements, and each element is supplied with a nerve fiber, which comes from large nerves originating in the nerve centers. It must not be supposed that the electricity is generated in the nerve centers and conveyed to the electric organs. It is really generated in the organ itself, but the latter is so arranged as to give a shock only when excited to action by impulses from the nerve centers. In the torpedo, which often weighs more than 80 pounds, the batteries are two large kidney-shaped masses, one placed on each side near the head and gills. In the electric eel there are four batteries, two large and two small, which run along the under side from the forward fins nearly to the end of the tail. The electric organs of the thunderer-fish form a layer beneath the skin, enveloping the entire body with the exception of the head and fins. The electricity given off by these fish is of the same nature as that produced by any of the appliances now in use, and produces the same physical phenomena. When a living electric fish is touched it may or may not give a shock; and it is evident that this is under the control of the animal and, just as it can flap its fins, so it can give an electrical discharge. The strength of the shock varies, and every fish has the power of giving shocks of different intensity. The electrical force is developed by some chemical process occurring in the plate in which the electric nerve filaments end. The side of the plate on which the nerves are placed becomes negative in the discharge. In the gymnotus, the posterior surface of the plate is negative and the discharge is from the tail to the head, while in the thunderer-fish the negative side is anterior, and the current passes from the head to the tail.

The force of the discharge of a full-sized gymnotus is probably somewhere between 300 and 800 volts.

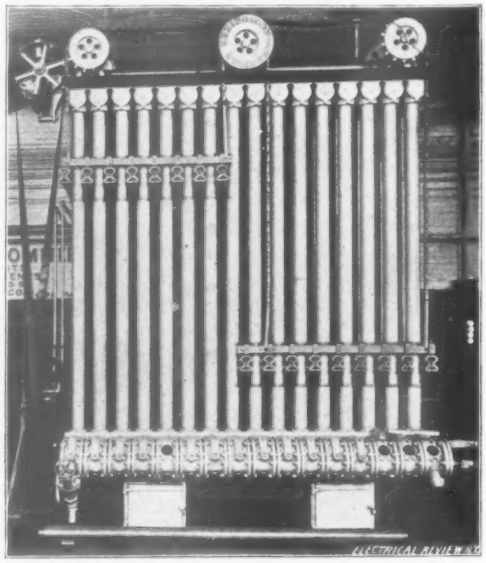


EXHIBIT OF THE AMERICAN ECONOMIZER AT THE ELECTRICAL EXPOSITION, NEW YORK CITY.

This fish, which gives the strongest shocks of all the electric species, is capable, under certain favorable circumstances, of stunning a man. Faraday made numerous observations on a specimen 40 inches in length.

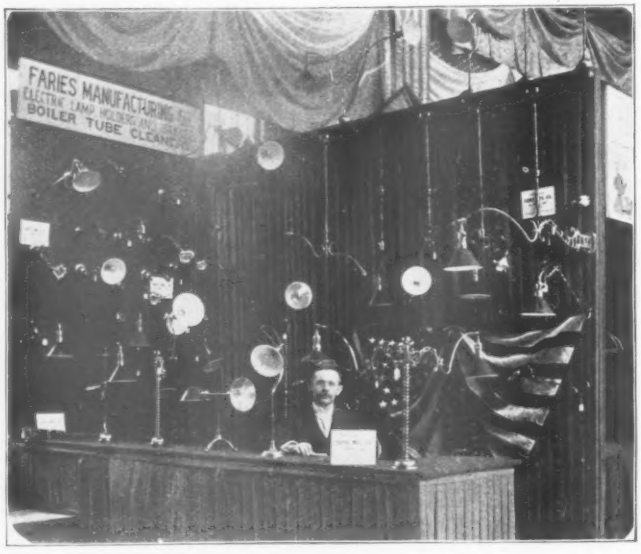


EXHIBIT OF THE FARIES MANUFACTURING COMPANY AT THE ELECTRICAL EXPOSITION, NEW YORK CITY.

He calculated that at each medium discharge the animal emitted as great a force as the highest charge of a Leyden battery of 15 jars. The strongest shocks were obtained by touching the gymnotus simultaneously near the head and tail, scarcely any shock being felt if the hands were placed one on each side, at the same distance from either extremity. On one occasion when a live fish was put into the tub the gymnotus was seen to coil itself into a semi-circle, the fish lying across the diameter. This was the most favorable position for giving the strongest shock. A moment later the fish floated dead upon its side, and was soon after devoured. All electrical fishes use their power to protect themselves and to obtain food. The shocks have sufficient strength to stun and even kill their prey, the same discharge producing a more powerful effect upon a large fish than upon a small one, since the larger animal presents a larger conducting surface to the water, through which electricity is passing, and hence it receives a more violent shock. The discharges give rise to momentary currents sufficient to deflect the galvanometer or to magnetize a needle.

It is remarkable that these batteries are constructed without the use of any insulating arrangements, and even the body of the fish itself is not protected from its own currents; which, in some species, pass through the brain and spinal cord. Since nerves are irritated by electric shocks it seems peculiar that the fish, when it gives a discharge, is apparently not affected either as to sensation or muscular movement. One would expect the fish to go through the most violent convulsions at each discharge, but it does not, to all appearances, suffer; even when giving off a shock strong enough to stun or kill its opponents. The only explanation of this strange immunity seems to be this: that the nerves by long habit have become so accustomed to electrical agitation that they are not susceptible to slight shocks. It has been found that currents from a coil having two Grove's elements in the primary circuit killed or rendered unconscious such fish as chub and pike, while a thunderer fish was not affected. When the current was increased the latter hastily withdrew from the regions of greatest density and took that position which, theoretically, was the least exposed to electrical currents. It looks as if these curious animals from experience in combats where the weapons were electric batteries, had learned that by taking a certain position (that in which the axis of its length is perpendicular to the direction of the current) the discharges of its enemies had the least effect. Their instinct teaches them to act like experienced electricians; thus the electric eel, when about to discharge, curves its body toward its victim and touches it with the nose and tail, in this manner giving the greatest possible shock.

Electricity is produced in these fishes on a much more economical plan than any yet devised by man; and by a careful study of their organs it is possible that we may learn some phenomena of which we are now entirely ignorant.

*From the *Yale Scientific Monthly*.

The Largest Rotary Converter Ever Built.

In the station of the Pennsylvania Heat, Light and Power Company, Philadelphia, Pa., has recently been installed by the General Electric Company the largest 60-cycle rotary converter yet constructed. It is a 16-pole machine, of 400 kilowatts capacity, running at 450 revolutions per minute, and was designed to convert an alternating two-phase current of 60 cycles frequency and voltage, variable between 165 and 220 volts, into continuous current at from 225 to 300 volts. It is designated QC 16–400–450, and stands eight feet high on a base eight feet four inches by eight feet six inches.

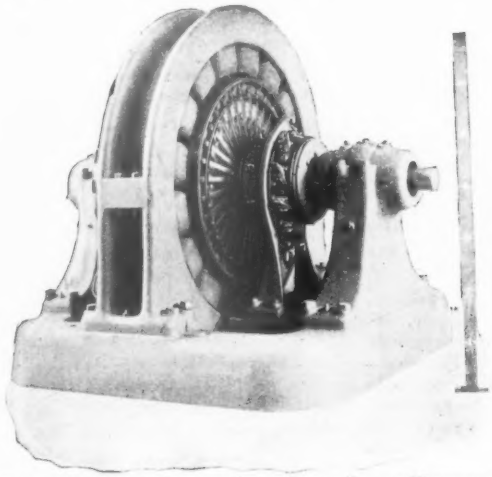


FIG. 2.—TWO-PHASE SIDE OF SIXTY-CYCLE ROTARY CONVERTER.

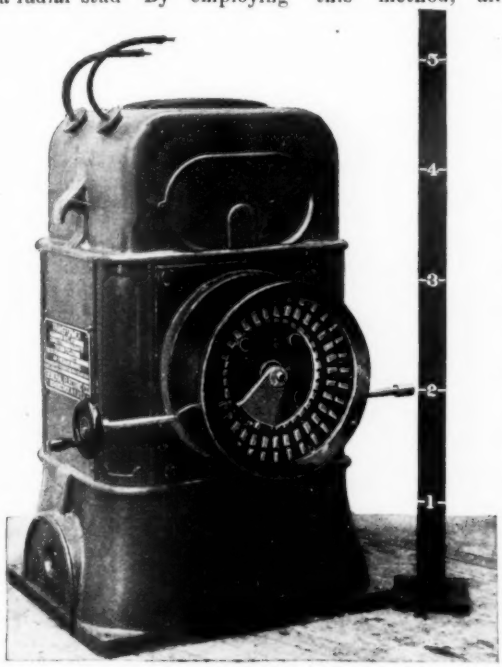


FIG. 3.—SIXTY-CYCLE TRANSFORMER.

The field frame of this machine is heavily ribbed, divided horizontally and susceptible of movement along the base to allow of inspection of the armature and field coils. The bearings are extra long and of the General Electric self-oiling and self-aligning type, that at the commutator end of the shaft being provided with an end-play device to keep the armature in constant motion in the direction of the length of the shaft, and distribute the wear of the brushes over the commutator surface to avoid the wearing of grooves. The armature is of the iron-clad type.

The commutator carried on a separate spider is of very ample service, and has a large number of segments. To facilitate the removal of a brush for examination and replacement without varying the tension under which it runs, a brush-holder of unique design has been devised. To remove the brush, the prolonged end of the brush-holder spring is disengaged from the brush-holder by a slight end motion.

Another valuable feature in this machine is the design of the brush-holder studs and the method of attaching them to the yoke. The former—instead of passing through insulating bushings in the yoke, as has been customary in this type of machine—is provided with a lug bored to fit down upon a radial stud held by bolts passing through the insulating bushings. To slide the brush-holder stud off, it is simply necessary to loosen the nuts on the bolts passing through the bushings. By employing this method, all labor and expenditure of time usually consumed in removing the insulating bushings and washers from the brush-holder yoke to remove the stud are avoided, and the change can be effected in a very few minutes.

Fig. 2 shows the two-phase side of the converter. Upon the collector rings press numerous leaf brushes, having a long contact on the rings, and a very large current-carrying capacity.

To obtain the necessary variation in the continuous-current of the rotary converter the General Electric Company has furnished with it two special 60-cycle transformers, each of 220 kilowatts capacity. These have been designed to operate with a primary potential of 2,000 volts, and a secondary potential varying from 165 to 220 volts. The variation is obtained through a dial switch over which passes a contact plate, cutting out or throwing in more or less turns of the primary winding and thereby varying the secondary potential. The switch is operated by a wheel-handle, and the potential may be varied rapidly in either direction, the contact plate snapping from contact to contact in one direction as well as in the other. The dial switch is applied to the transformer itself instead of being a separate device, and the entire construction is singularly compact.

The rotary converter before shipment was subjected to a more than usually severe test. It is now operating satisfactorily in the station, running under heavy loads without sparking or cutting at either the commutator or collector rings.

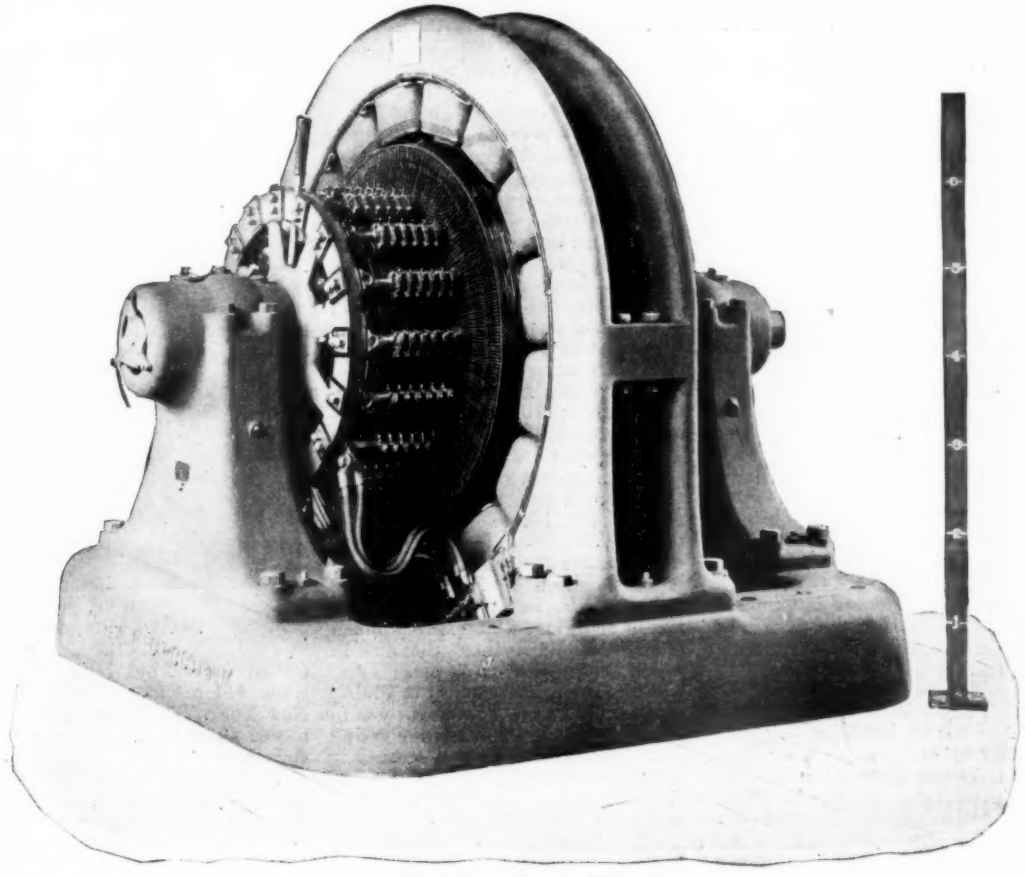


FIG. 1.—SIXTY-CYCLE ROTARY CONVERTER.

THE LARGEST STORAGE BATTERY IN THE WORLD.

(Concluded from page 349).

on each side of the system. Fig. 2 shows the end cells and gives a view of the end-cell switchboard in the background.

These switches have 30 points and are capable of carrying 2,750 amperes each. The connection between the 30 contacts and the bus bar of the enables the operator to take the voltage of the end-cell switches.

The installation of this battery has developed several important features not ordinarily employed in battery installations. As a very striking innovation may be mentioned the method of charging without the use of boosters, usually necessary to obtain a sufficiently high-charging pressure. The method used by the Chicago Edison company is to operate a pair of 200-kilowatt machines in the Harrison street station at about 180 volts, which is the voltage required for charging, and send the current over a portion of trunk line from Harrison street to the battery station at Adams street, the voltage regulation of the dynamos being effected by an automatic control of the field resistance, by means of small motors, which are controlled by the operator in the battery station. Small lead-covered cables are run from Adams to Harrison street, connecting with the motors controlling the field boxes. These generators, which are used for charging, are not generators specially made for the purpose, but are the same ones which at other periods of the day are used to feed into the main bus bar of the station, thus saving an investment of about $15,000 in boosters, as well as providing a system of charging, which is very much more economical than the one in which boosters are employed.

While the primary object in adding this battery to the equipment was to take care of the gradually increasing peak of the load which, as already stated, in Winter time reaches approximately 12,000 amperes, lasting as long as one and one-quarter hours; it will be kept in circuit at all hours during the daytime in Summer, keeping the engines at the central station working at their most economical point, the battery being ever ready to lend a helping hand in case of any sudden increase in load which may occur in the system. Another important point is, that by maintaining the battery constantly on the circuit, the necessity for pressure regulation is very much lessened. The addition of this battery to the generating plant of the Edison company marks the almost final step towards a perfect system of direct-current distribution, and its performance will be watched with interest by the electrical engineers of the world. In closing, the ELECTRICAL REVIEW correspondent wishes to express high appreciation of the courtesies shown by President Insull and his staff of engineers in furnishing data, information and illustrations embodied in this article.

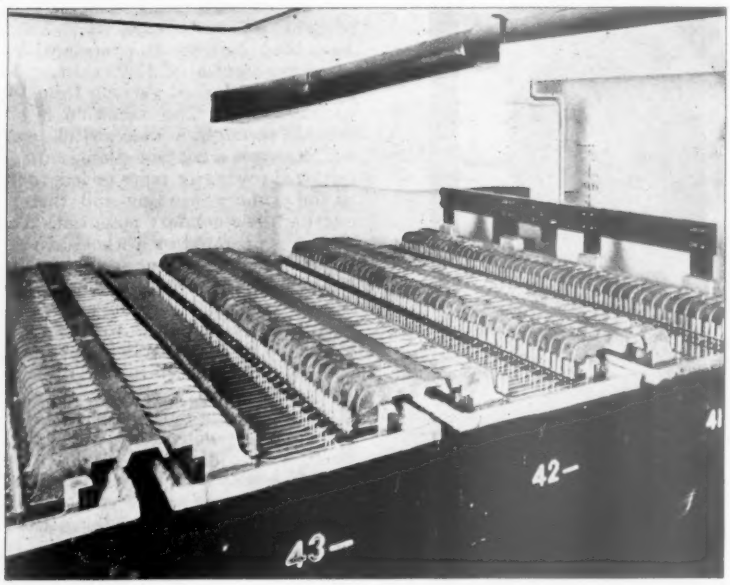


FIG. 4.—END VIEW OF TWO CELLS, SHOWING SERIES CONNECTIONS.

switch is made by a laminated copper brush, traveling on a screw operated by one-half horse-power series motor. These motors are put into operation by push buttons on the controlling switchboard, but are stopped automatically, when the brush reaches the mid-point on the contact block, by an automatic device, which breaks the motor circuit and short circuits the armature. This method insures the positive action of the end-cell switch without requiring the attention of the switchboard operator. These switches are provided with a hand wheel for hand operation if desired. Gear wheels are provided so that the three switches can be geared together and operated as one switch, thus giving a capacity of 8,250 amperes on each side of the system.

CONTROLLING BOARD.

The controlling board is connected to the bus bars of the end-cell switches by 12 cables of 1,500,000 circular mils each. On the controlling board there are three single-pole switches for each end-cell switch, enabling it to be connected to either the main, auxiliary or charging busses. Each end-cell switch has an indicator on the controlling panel, operated mechanically by light shafting and gearing, which shows the operator the exact position of the traveling brush on the end-cell switch at all times. On each panel of the board there is a 30-point voltmeter switch, connected to a low-reading voltmeter, which

R. Z. Jimenez Arrested as a Spy.

R. Z. Jimenez, who until recently has been well known among the electrical fraternity in New York, was arrested last week at Key West, Fla., as a suspected Spanish spy. He was found on the prize steamer "Panama," and a search of his effects is said to have revealed a cipher code which turned out to be a key to 59 charts of the Atlantic coast from Maine to Florida. His statements during his examination were contradictory.

Jimenez stated that he had been an engineer in the Spanish Navy in Cuban waters, but retired in 1890, since which time he has resided in New York. This is probably true, as it was about that time he made his appearance in New York and called at the ELECTRICAL REVIEW office in search of employment. He has been employed in the past with several of the large electrical manufacturing companies, and until recently had an office in Broad street, New York city, where he was supposed to carry on an export business in electrical machinery and supplies.

A New Tipless Lamp.

The American Incandescent Lamp Company, Warren, Ohio, is among the latest concerns entering the field of manufacturing incandescent lamps, and, with a lamp possessing several novel and meritorious features, will, no doubt, secure a liberal share of the business. The lamp is tipless and of oblong shape, having a convex surface at each end. This, it would seem, must contribute largely to a more perfect radiation of light from the bulb. From tests made so far, the lamp promises to be remarkably long-lived and maintain its normal candle-power without a decrease in efficiency. The company will furnish lamps of any desired efficiency, but advocates 55 watts per 16 candle-power as the most satisfactory quality. Mr. C. C. McNutt, Jr., is general manager of the new company, and Mr. A. H. Kreitler secretary.

Sixty-nine pictures appear in the current number of *Collier's Weekly*; eight of them are portraits of Gladstone at different periods of his life, and four have other subjects, but more than 50 are of objects, scenes and individuals made specially prominent and interesting by the war with Spain. More than a month ago Mr. Hare, of the *Weekly's* photographic staff, went, with two other journalists, to the camp of the insurgent-general Gomez with the first news of American intervention in Cuba. Mr. Hare wrote a description of the trip and took scores of photographs; the first installment of his narrative, with about 20 of his pictures, appears in the current number.

FIG. 5.—VIEW, SHOWING REAR PORTION OF BATTERY-ROOM.

The Standard Air-Brake Company's Equipment for Surface Cars.

An improved axle-driven air brake, especially designed to meet the requirements of high-speed interurban cars, has been worked out and placed upon the market by the Standard Air-Brake Company, of New York city, of which Mr. Joseph R. Ellicott is general manager. Interurban service calls for an air brake that shall be efficient and durable. To meet the requirements of durability, the compressor must be in operation only such part of the time as is required for actual compression. A system embodying this necessary principle has been perfected and tested for a considerable period by the Standard Air Brake Company. The system maintains automatically maximum air pressure for every stop, and automatically causes the air compressor to start and stop when the minimum or maximum pressure is reached. It operates only as needs require, and at all other times it remains at rest.

The complete equipment consists of the following essential parts: An air pump, its driving mechanism, the case containing the driving mechanism, a governor, a reservoir, a brake cylinder, an operating valve on the head of the brake cylinder, and a platform equipment consisting of operating staff, interlocking handle, and pressure gauge. In the illustrations, Fig. 1 shows the plan and side view of the whole equipment, Fig. 2 shows the air pump, and Fig. 3 the governor.

A split gear fastened to the car axle and in mesh with a second gear, which runs free on the pump shaft and also forms one member of a friction clutch, comprises the driving mechanism. The friction clutch consists of a series of plates, half of which rotate with the clutch gear but are free on the shaft, while the other half, placed alternately between them, rotate with the pump shaft, but have a lateral motion on the same. When pressure is applied, the plates are forced together, causing the pump shaft to rotate, but, it is claimed, without any starting shock. The pressure is applied by the governor by means of a shipper, yoke and collar on the shaft. The casing is dust-proof, and contains all the driving parts except the pump and governor, which are bolted rigidly to it. Within the casing and pump is about one gallon of oil, which furnishes lubrications to the bearings and working parts without any appreciable escape of oil at the journals.

The pump is double acting, having a piston cast hollow and in one piece, within which is the crank, crank brass and ways. The bearings are inside, and beyond the reach of dust to cut them out. The suction and discharge valves are in a cylinder body, and are provided with movable seats to facilitate repairs. There is but one connection for the suction and one for the discharge. The heads of the pump are free of valves or piping. Means are provided to relieve the clutch of any strain when thrown into action.

The governor consists of two cylinders, of different diameters, in one casting, fitted with two corresponding pistons. The air pressure is always in a smaller cylinder and when the air reaches a predetermined maximum pressure, it overcomes the resistance of the spring, disengages the friction clutch, and the pump remains at rest. When the air drops to a predetermined minimum pressure, the air in the valve chamber has not pressure enough on the piston of the hollow-valve stem to resist the force of the spring and so moves back, drawing the slide valve with it until it opens the port from the larger cylinder to the exhaust. The air pressure which held the clutch out of engagement is released, and, since the air pressure is always on the smaller cylinder, this throws the clutch into engagement again, and the pump recharges the reservoir to maximum pressure.

The reservoir is of the cold-weld type and is air-tight. The brake cylinder is the ordinary hollow-spindle type attached to the floating lever. The leverages on the car are not changed, and the hand-brakes can be used just as though there were no air brakes on the car.

The operating valve is bolted to the brake cylinder head, which obviates all piping for this purpose and the danger from leaky pipe connections is entirely avoided. There are three ports under the slide valve, a small port for service stops, a large port for emergency stops, and an exhaust port. The lap of the slide valve is long enough to cover both the service and emergency ports at the same time. It is claimed that the average horse-power to the car mileage for working the brake will not exceed one-eighth of one horse-power.

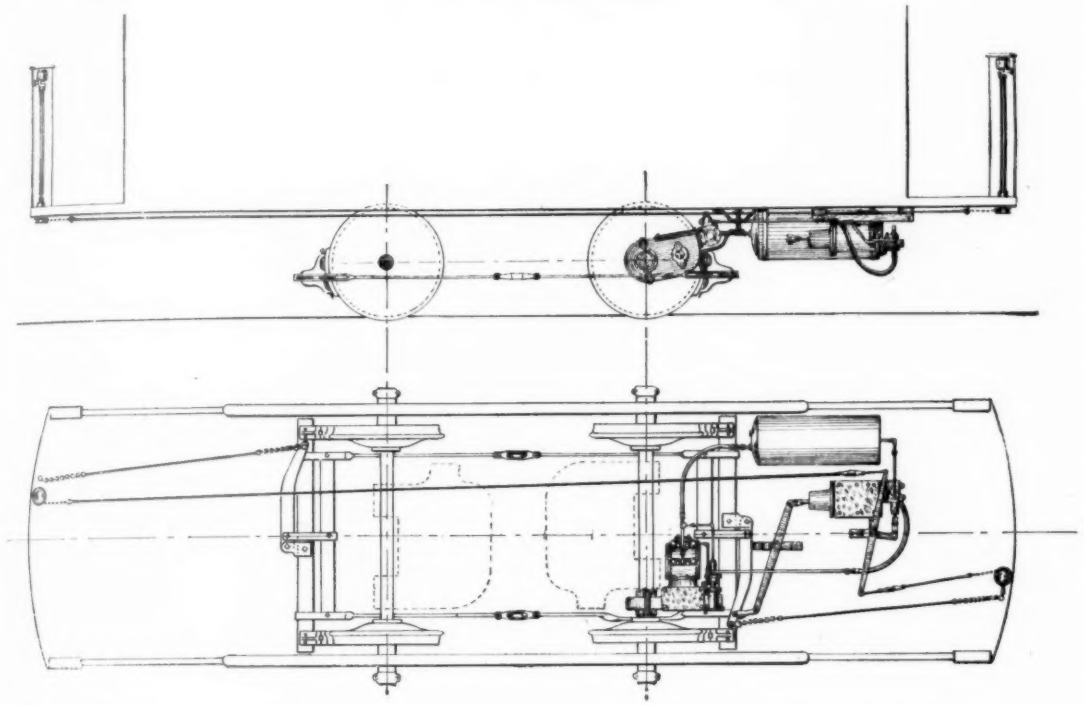


FIG. 1.—PLAN VIEW AND SIDE ELEVATION OF THE STANDARD AIR-BRAKE COMPANY'S EQUIPMENT FOR SURFACE CARS.

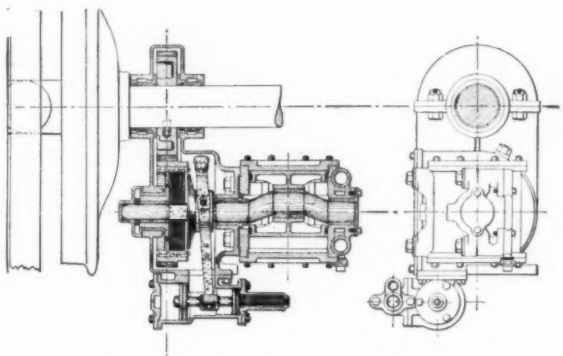


FIG. 2.—AIR-PUMP, STANDARD AIR-BRAKE EQUIPMENT.

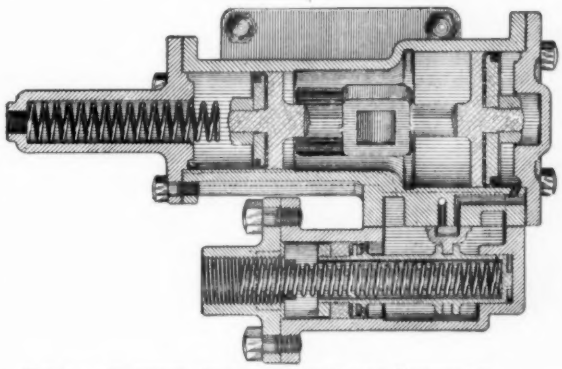


FIG. 3.—GOVERNOR, STANDARD AIR-BRAKE EQUIPMENT.

Street Railway Contract in Canton, Ohio.

Mr. Lewis N. Ley, City Clerk, informs the ELECTRICAL REVIEW that the proper party to address concerning the construction and operation of street railway route No. 3 is Mr. R. R. Jacobs, care of J. P. Fawcett, Canton, Ohio.

Judgment for $28,356 has been entered against the Buffalo, Kenmore and Tonawanda, N. Y., Electric Railway Company in favor of John B. Dumont for the amount due on 19 notes of the company, and also for money advanced to the company by the Erie Construction Company, which claim has been assigned to Mr. Dumont.

Kindred.... ...Interests

The Johnson Company, of Lorain, Ohio, and Johnstown, Pa., has issued catalogue No. 11 of its girder rails and other products for street railway construction.

The Western Electric Company, Chicago and New York, has issued a bulletin descriptive of its 1898 desk and bracket fan motors. The bulletin may be had free on application.

The American Wheelock Engine Company, of Worcester, Mass., have issued a handsome catalogue of the Greene-Wheelock engines, with Hill valve gear for any capacity and any service.

The Warren-Medbery Company, of Sandy Hill, N. Y., manufacturers of the improved inductor alternator, report a fine rush of business. This new company is enjoying a very brisk sale of its apparatus, and is working all the hands of experience in this particular field that it can employ.

The Electric Storage Battery Company, through its New York manager, Mr. Chas. Blizard, has just sold to the Edison Electric Illuminating Company of New York a 4,000-ampere hour battery of chloride accumulators. This is the third order received from the Edison company.

The Peck, Stow & Wilcox Company, 27 Murray street, New York, with factories at Southington, Ct., are very extensive manufacturers of all kinds of pliers, including specially insulated pliers, cast-steel side-cutting pliers and combined pliers and cutting nippers. The product of this company is very largely used in electrical work.

The Bristol Company, of Waterbury, Ct., has issued a revised partial list of its recording instruments for pressure, temperature and electricity. Although this list includes 117 different varieties and ranges of instruments the company is constantly making additions to meet any special requirements. The list will be mailed free on application.

The new building which the Waterville Cutlery Company are erecting at Waterville, Ct., will have a steel roof which is being erected by the Berlin Iron Bridge Company. The trusses are steel, and the covering is corrugated iron, lined with the Berlin company's patent anti-condensation fireproof lining. The building is 21 feet wide and about 100 feet long, and is to be used as a forge shop in one end, and in the other will be located the boilers and engines.

The Lyman Mills, which is the largest mill corporation of Holyoke, Mass., employing about 1,500 hands, is a progressive concern, and their recent adoption of electric power for the operation of their machinery will undoubtedly have a marked influence upon many other firms in their vicinity. The Westinghouse Electric and Manufacturing Company has installed for the mills a 250-kilowatt, 440-volt, two-phase, 3,600-alternation generator, direct connected to an Allis-Corliss engine running at 120 revolutions per minute. Six Westinghouse type "C" motors, varying in size from 30 to 75 horse-power, are used for the operation of spinning frames, mules, looms, the machine ships, etc.

The new air-tight open-circuit battery, called the Badt hermetic cell, is receiving the approbation of all engineers and electricians who have been obliged to deal with the troublesome question of primary batteries. The oil seal, which so positively prevents the evaporation of the liquid, the creeping of salts and the constant premature disintegration of zincs, is the latest novelty in batteries, and is a feature which strongly recommends this cell for use. The Western Electric Company, of Chicago, which recently announced in its advertisement that it was headquarters for batteries of various kinds, announces that the Badt hermetic cell is also added to its list of batteries.

The Beach-Cook automatic transfer system for telephone exchanges makes life worth living, according to Manager Doolittle, of the Sterling Electric Company, Chicago, especially to the exchange manager. "While I was managing the exchange at ——," said Mr. Doolittle, "we used for a long time the old manual system of transfers. Matters became so bad that I had to sneak through back alleys when going home or to lunch for fear of meeting some angry subscriber who wanted to complain about the service. We finally put in the Beach-Cook automatic, after which I was enabled to once more walk the streets in daylight, attend lodge and other meetings, take my family to the opera; in short, I was once more a respected citizen."

(Continued on page 363.)

AN electrical and mechanical establishment wishes for direct connections with manufacturers of machinery for electrical plants. Please address,

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Care Aug. J. Wolff & Co.'s Advertising Office,
COPENHAGEN, K.

A BARGAIN.

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Address A. H. Potts & Co.,
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20 YEARS, NOT CHEAP BUT SERVICEABLE AND FULLY GUARANTEED.
CIRCULARS FURNISHED.
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DIRECT-READING AMMETERS
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VOLTMETERS,
Like cut, reading from 0 to 10, at $1.50 each. 0-25 at $5.00 each.
Cherry Electric Works,
25 & 27 3d Avenue, NEW YORK.

Quick-Break Switches.

If you desire the best, latest and most improved quick-break switch on the market, get the

"DEMARY."

They are all made of the best material that can be obtained, and all parts are standard in size.
These switches are made in one grade only, highly polished and lacquered.

Send for Catalogue and Prices.
They will interest you.

R. C. DEMARY,
133 Erie County Bank Building. BUFFALO, N. Y.
MARYLAND AGENTS:
Cookman Electrical Mfg. Co., BALTIMORE, MD.

IRON ROOF FOR SALE.

Dimensions of building—87 ft. in width, 225 ft. in length, one story in height; side walls and gables of brick; building designed for a machine shop, but, owing to the failure of the purchaser, the iron roof trusses are now offered for sale at a bargain. The roof is admirably adapted for a machine shop, car barn, paper mill, or for any other general manufacturing purposes.

Apply to

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Full of Life and Even Temper!
SMALL
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OF EVERY DESCRIPTION MADE BY
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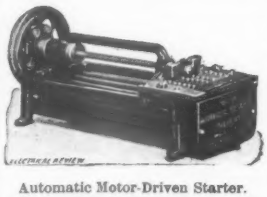
ESTABLISHED 1857.
FLAT OR ROUND WIRE, STEEL OR BRASS. A complete assortment of high-grade COLD ROLLED STEEL kept in stock, .003 to .049 inch thickness.
Springs enameled or plated. Tempering done at short notice. Ribbon steel made to order.
Send samples and write for quotations.



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Desiring a **thoroughly reliable** Automatic Starting Apparatus for electric pumps, elevators and other intermittent work, can not do better than send for our catalogue of Motor-Driven Starters and Specialties. No dash-pots, shunt magnets or other delicate mechanism, yet automatic start and instantaneous release under all conditions.

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For Mich., Wis., Ill., Ind., and Iowa, Harding & Hammer, Marquette Bldg., Chicago.
For Louisiana, Vincent Gray, New Orleans.

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GENERAL ELECTRICAL SUPPLIES

Bargains in Dynamos, Engines, Etc.

Direct-current dynamos of 350, 700, 725, 800, 810, 900, 1,075, 1,350, 1,610 and 2,500 light capacity.
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Arc dynamos, 20, 24, 30, 40, 50 and 60 lights, both 1,200 and 2,000 candle-power.
Engines, 50, 75, 85, 100, 115, 125, 150, 175 and 200 horse-power.
Boilers, 100, 250, 375 and 500 horse-power.
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Pumps, all sizes.

Write us for Price-list No. 21.

This apparatus has been removed from our own Central Stations to make room for larger units. We therefore know its history and can guarantee it to be in thoroughly good operative condition.

CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

KINDRED INTERESTS.

(Concluded from page 362.)

St. Louis Electrical Supply Company writes that it is selling enough Meston fan motors to blow all the Spanish ships off the Atlantic coast. That probably accounts for the trouble in locating it.

The American Tool Works Company, of Cincinnati, Ohio, have received, through their office at London, orders from Wimhurst, Hollick & Company, of London, amounting to $12,000, including engine lathes, planers, radial drills, upright drills, bolt cutters, milling machines, chucking lathes. Also orders from Pearson, Bennin & Company for a number of lathes and drill presses.

In addition to their usually complete line of fan motors operative upon electric light circuits, the Central Electric Company, of Chicago, in order to meet the gradually increasing demand, have placed in stock a very complete line of fan motors operative from storage and primary battery circuits, prominence being given to the Edison-Lalande battery fan outfits. There is many a place and many a time when these atmospheric accelerators prove to be very serviceable. In a sick-room they serve to keep a gentle circulation of the air that is exceedingly refreshing to a patient. Special circulars will be sent on application.

Brill Standard Sprinkling Cars —The ELECTRICAL REVIEW has received a neat leaflet from J. G. Brill Company, Philadelphia, describing at some length their improved Brill standard sprinkling cars. There will no doubt be an extensive demand for these cars, if dust ever should come again. At the present writing, however, having had some 69 days of wet weather, the demand for sprinkling cars will not be very extensive in the electric railway field until after we have had a good deal of sunshine; and when the hot, dusty days come, there is nothing better than the Brill standard sprinkler to keep electric railway passengers cool and comfortable.

The Electric Appliance Company have recently closed a general western agency arrangement for the Armorduct interior conduit. The Armorduct is the latest product of the Armorite Interior Conduit Company, manufacturers of the well known Armorite steel armored interior conduit. The Armorduct is a steel tube, heavily enameled inside and outside by a special and exclusive process. The enamel placed on this tube gives a perfectly smooth interior, with a coating which will withstand a temperature of 500 degrees. Bending and twisting the tubes will not crack or break the coat of enamel. The enamel is stated to be absolutely proof against the action of cements or acids of any description. The Electric Appliance Company undoubtedly have a very valuable specialty in their Armorduct, and large sales may be safely prophesied.

J. G. WHITE & COMPANY,
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Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED MAY 24, 1898.

604,358 Valve-controlling device; W. S. Alexander, New York, N. Y.

604,373 Automatic telephone exchange; Ward Decker, Owego, N. Y.—In a system of electrical intercommunication, a short circuited telephone receiver, a circuit breaker for breaking the short circuit, an electro-magnet for operating the circuit breaker, all in combination with a calling generator connected with said electro-magnet, whereby the short circuit is broken on operating the calling generator.

604,384 Electric heater; E. E. Gold, New York, N. Y.—An electric heater comprising an insulating open-work support, consisting of a thin foraminous tube, and a helix of resistant wire wound helically around said support, whereby air may circulate between the meshes of said helix and through the openings into and out of the interior of said support and into contact with all portions of the heated resistance wire.

604,418 Accumulator plate; I. Rosler, Berlin, Germany—An accumulator plate consisting of a continuous zigzag core piece, the surfaces of which on both sides are fitted with triangular webs wholly separated from each other.

604,431 Electric signal for railway crossings; L. C. Smith, Columbus Ohio.

604,434 Telephone signal system; W. A. Stillwell, Salina, Kas.

604,453 Secondary electric clock; A. D. Blodget, Newton, Mass.

604,459 Electric meter; T. Duncan, Fort Wayne, Ind.—An induction motor meter provided with an armature, coils acting inductively on the armature, a magnetic drag also acting on the armature, and a shield of conducting material embracing the armature between the coils and drag.

604,460 Electric meter; T Duncan, Fort Wayne, Ind.

604,461, 604,462, 604,463, 604,464, 604,465, 604,466 Electric meters; T. Duncan, Fort Wayne, Ind.

604,471 Electric brush; E. M. Hellwig, Chicago, Ill.—Consists of a body having a cavity in its upper face and a handle carrying a contact plate, bristles set in the lower face of the body, two metal sockets set in the base of the cavity but out of contact with the bristles, a conductor connecting the latter with one of said sockets, and an insulating and waterproof covering over the conductor and the upper ends of the bristles, a wire connecting said handle contact plate with the other socket, a battery located within said cavity above the insulation, and means for connecting its poles with the two sockets.

604,499 Multiple telephony and telegraphy; Richard Pfund, New York—A through metallic circuit having telephone stations included therein or connected therewith, signaling magnets for said stations bridged across the two wires of the circuit, an extra circuit un ting the middle points of the signal magnets whereby an independent circuit is obtained between the stations, and instruments for communication located in said extra circuit.

604,501 Motor wattmeter; C. D. Raab, Kaiserslautern, Germany—A motor wattmeter having a disk armature, two horseshoe electro-magnets placed near each other at one side of the disk armature and a main-current solenoid at the other side thereof.

604,508 Electric clock; William Whitehead, Manchester, England.

604,511 Driving mechanism for dynamos; P. W. Alexander, Allapha, Ga.

604,544 Electrical governor; M. A. Replogle, Akron, Ohio.

604,588 Storage battery; H. S. Lloyd, Philadelphia, Pa.

604,616 Automatic resetting fusible cut-out; J. D. Holmes, St. Louis, Mo.—A fusible cut-out consisting of a rotary member, radial fuse-holding arms pivotally mounted thereon to swing in radial planes, said rotary member being normally locked against rotation, and means for releasing said rotary member when a fuse is burned out.

604,626 Electrical lighting device for kerosene or other burners; S. M. Meyer, Brooklyn, N. Y.

604,679 Incandescent electric lamp regulator; D. McF. Moore, New York, N. Y.—A system for regulating the current which operates an incandescent electric lamp, consisting of an incandescent electric lamp with a magnet in circuit therewith, means for automatically and variably opening and closing both the circuit of said magnet and that of said lamp at terminals which are independent of a surrounding rarefied or inert gas.

604,680 Electric lamp regulator; D. McF. Moore, New York, N. Y.

604,681 Interrupter for electric lighting systems; D. McF. Moore—Consists of an interrupter working in a sealed receptacle, a pair of actuating magnet poles arranged at opposite sides of an armature carried by said interrupter, and means for energizing said magnets in alternation, over a circuit independent of the interrupter.

604,682 Magnetic circuit-breaker; D. McF. Moore, New York, N. Y.—In a circuit in vacuo, the combination with the vibrating member, of co-operating contacts located in substitute relation to one another.

604,683 Magnetic circuit breaker; D. McF. Moore, New York, N. Y.—Consists of a circuit of induction, circuit-breaking magnets in said circuit, and a contact tongue alternately actuated thereby to repeatedly make and break said circuit, and a circuit to receive the discharges of the circuit of induction.

INDUSTRIAL NOTES.

The Pennsylvania Railroad offers round-trip rates of a fare and a third to the Electric Light Convention at Chicago, which occurs on June 7, 8 and 9. Delegates from Philadelphia, Harrisburg, Pittsburgh, etc., will find the Pennsylvania a most convenient and comfortable route.

The Auditorium Hotel, Chicago, has been selected as headquarters for the Electric Light Convention, June 7, 8 and 9. The management has provided for committee and meeting rooms, and will take care of all other arrangements desired. Accommodations may be had on either the American or European plan, with rates from $3.50 to $5 per day American, and $2 to $4 per day European.

PATENTS TRADE-MARKS COPYRIGHTS

EDWARD S. DUVALL,

Solicitor of Patents.

Counsellor in Patent Causes.

Some time connected with the late Benjamin Butterworth, before he retired from practice to assume the office of Commissioner of Patents.

Prompt attention given to all matters before the Patent Office, and applications for patents prepared here at Washington from sketches, photos, or models, in a manner to give highest satisfaction and with less expense than you will incur elsewhere. Write and convince yourself of this fact. As an attorney at Washington is indispensable you can save the expense of having two by communicating directly with me.

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THE "Chloride Accumulator" IN Central Stations

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The San Francisco Gas and Electric Co. 150 Chloride Accumulators Of 6,000 Ampere Hours' Capacity.	Cleveland Electric Ill. Co. 160 Chloride Accumulators Of 4,000 Ampere Hours' Capacity.	U. S. Electric Lighting Co. Washington, D. C. 150 Chloride Accumulators Of 4,000 Ampere Hours' Capacity.	Richmond (Va.) Railway and Electric Co. 150 Chloride Accumulators Of 1,000 Ampere Hours' Capacity.	Germantown (Pa.) Electric Light Co. 120 Chloride Accumulators Of 1,000 Ampere Hours' Capacity.	Claremont (N. H.) Electric Light Co. 126 Chloride Accumulators Of 400 Ampere Hours' Capacity.
The Brooklyn Edison Co. (First Order) 140 Chloride Accumulators Of 4,000 Ampere Hours' Capacity.	The Brooklyn Edison Co. (Second Order) 156 Chloride Accumulators Of 6,000 Ampere Hours' Capacity.	The New York Edison Co. (First Order) 150 Chloride Accumulators Of 4,000 Ampere Hours' Capacity	The New York Edison Co. (Second Order) 150 Chloride Accumulators Of 4,000 Ampere Hours' Capacity.	The New York Edison Co. (Third Order) 150 Chloride Accumulators Of 4,000 Ampere Hours' Capacity.	

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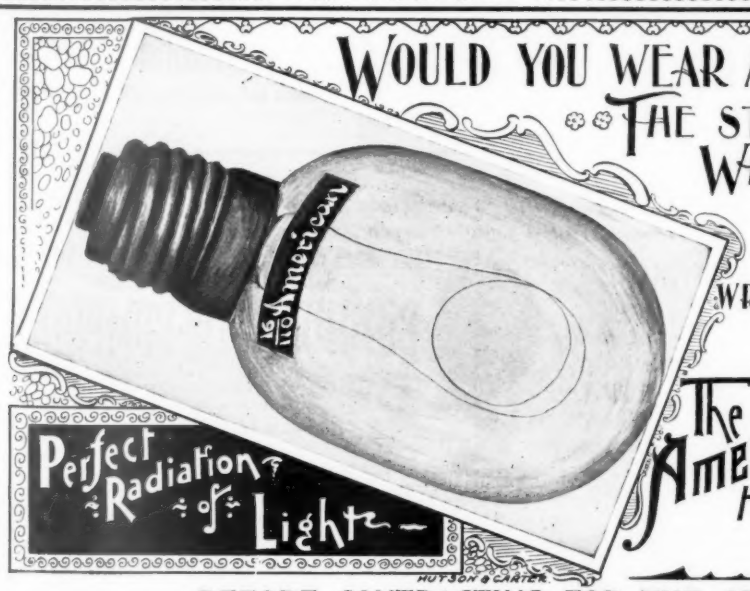

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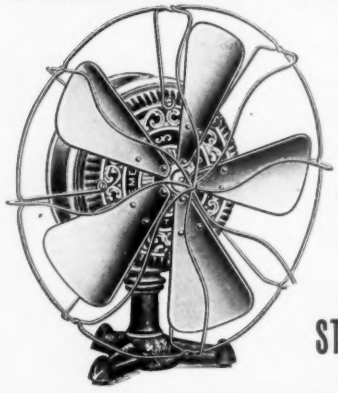

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